FOUNDRY
EST. 1902 TRADE JOURNAL
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL
VOL. 108
No. 2262
Registered at the G.P.O. as a Newspaper
APRIL 14, 1960
Offices: John Adam House, John Adam St., London, W.C.2
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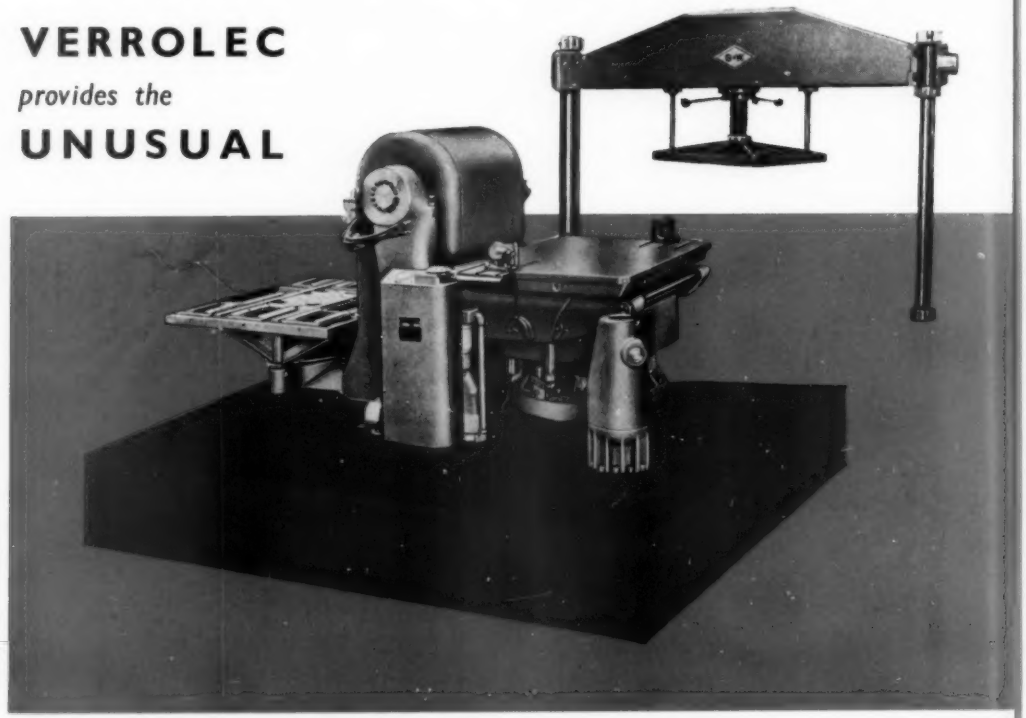

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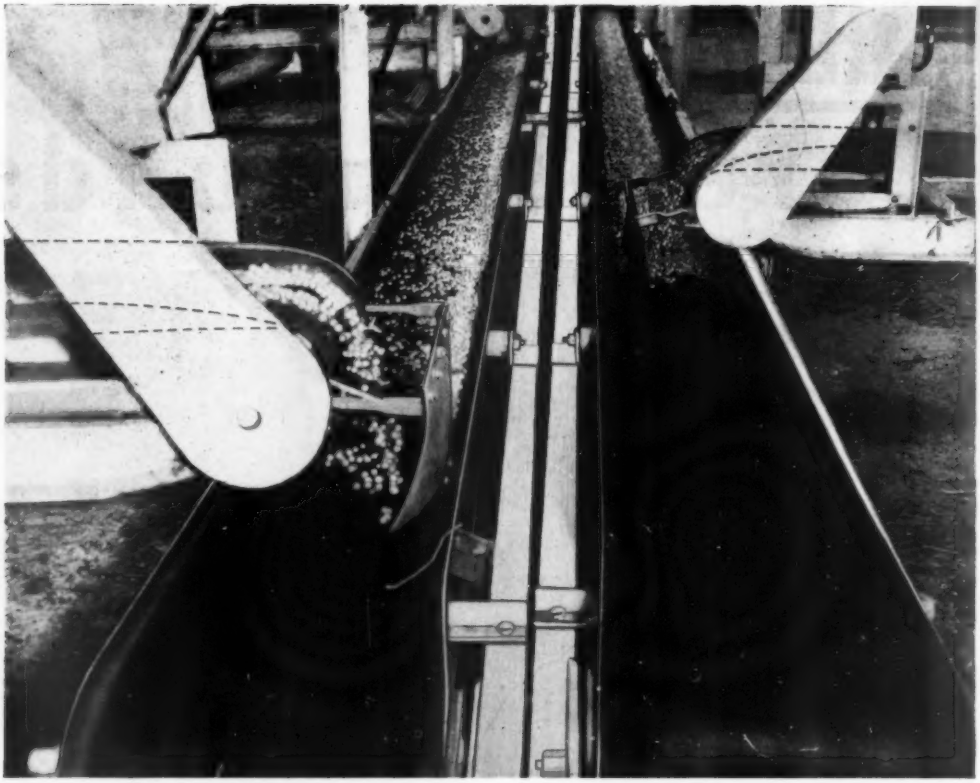
Manufactured by

HARBOROUGH CONSTRUCTION CO·LTD·MARKET HARBOROUGH



ROWNSONS **12″** wide Capacity U Belt running at 220 feet per minute will carry 2,580 cubic feet of material per hour; equivalent to **60 tons** of Granulated Sugar or Salt without spillage, the material being safely contained between the vertical sides. Harmful static rubber side skirting is eliminated by using the U Belt—the belt with the Built-in sides.

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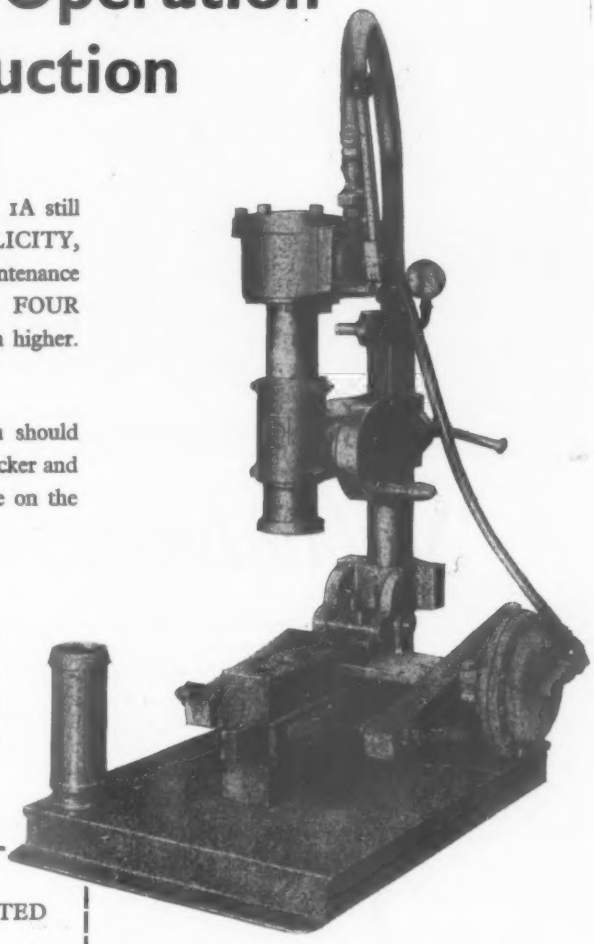
Single Lever Operation Higher Production

The New Single Lever Redford No. 1A still retains its STRENGTH and SIMPLICITY, but reduces operational time, maintenance costs and labour fatigue. With FOUR operations in ONE production is even higher.

If you make cores up to 2 lbs. you should use a Redford. It will make them quicker and cheaper than any comparable machine on the world market today.

It has great adaptiveness and is used widely co-operating the CO_2 process and the design provides rapid action to all adjustable parts, including the pneumatic clamps.



To BRITISH RONCERAY LIMITED

Please send me further details of the Redford Core Blower/Redford Pneumatic Clamp without obligation.

Name .....

.....

Just attach to one of your letter-headings and post to-day to:—

BRITISH RONCERAY LIMITED

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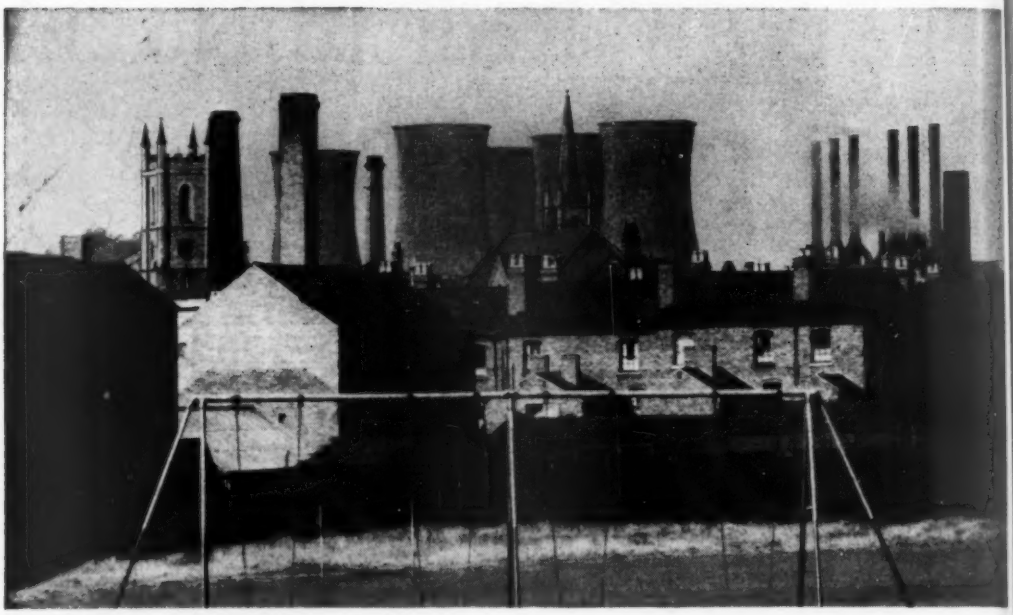

Staffordshire Landscapes

Almost in the shadow of the new power station, factory chimneys and church spires point skywards side by side—silhouetted symbols of material and spiritual welfare.

The children who sometimes play in the foreground have much for which to thank the early Iron founders, whose skill and industry brought to the Black Country prosperity, and a progressive outlook; creating, as the years went by, new industries and cleaner power, better homes and safer playgrounds.

Progress in Staffordshire, bringing almost every major improvement in the technique of iron-founding since 1700, is apparent in the landscape of the County as well as in its products.

For almost a century and a half Pig Iron has been manufactured at Darlaston Iron Works. Today, the most modern methods of metallurgical control of raw materials and the finished product, enables them to supply Pig Iron of consistent uniformity to the most exacting specification.

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DARLASTON · STAFFORDSHIRE

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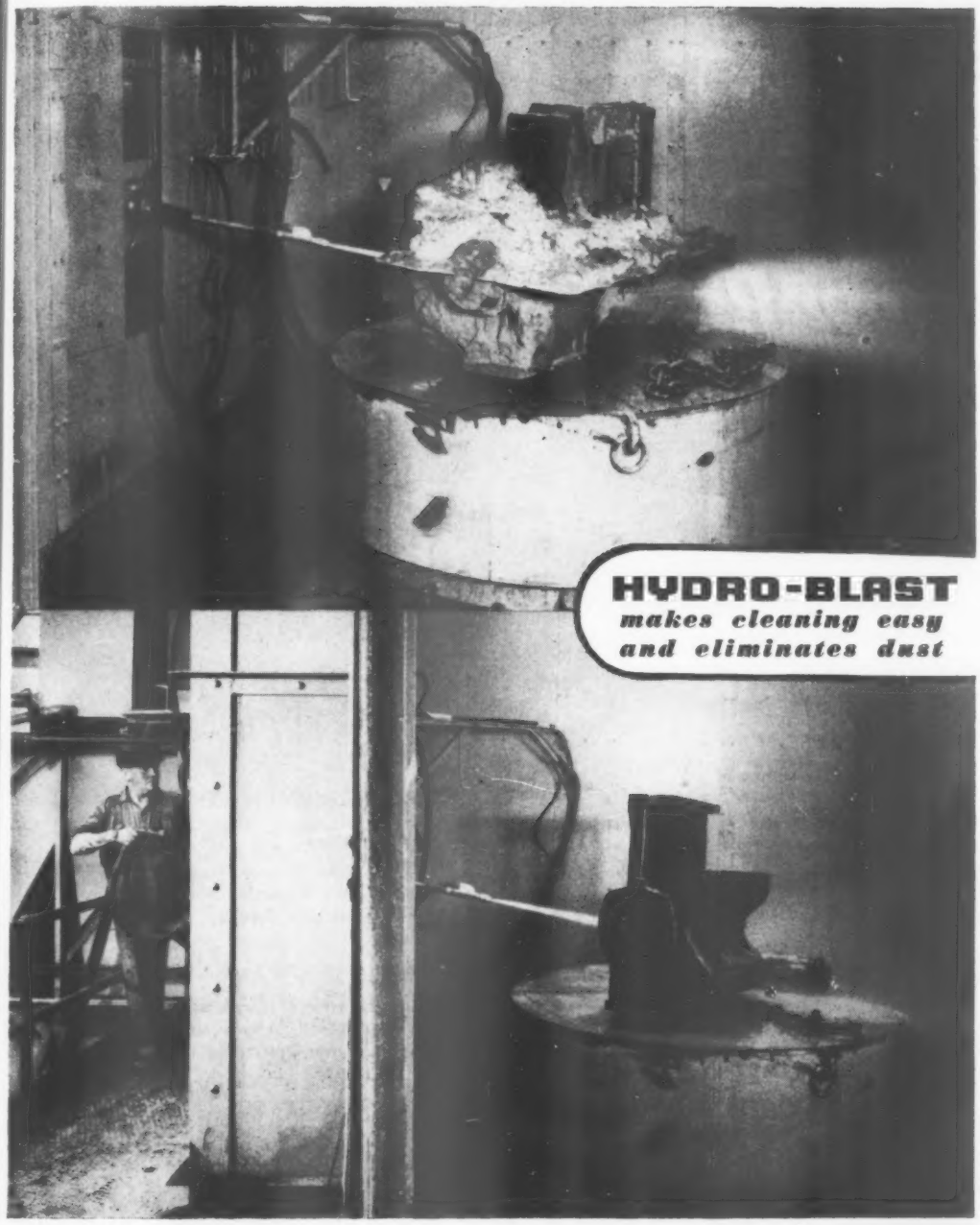

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Roper

WET TYPE SPARK ARRESTERS

Designed by experts—the example shows the simple but scientific approach to a vital problem.

Photographs by courtesy of
BILSTON FOUNDRIES LTD.

Above:
View showing Wet type Spark Arresters with Inspection Platform serving 17-ton per hour Cupolas.

Left:
This highly efficient Spark and Dust Suppressor is provided with a Spray Jet giving double water curtain as illustrated.

E. A. ROPER & CO. LTD
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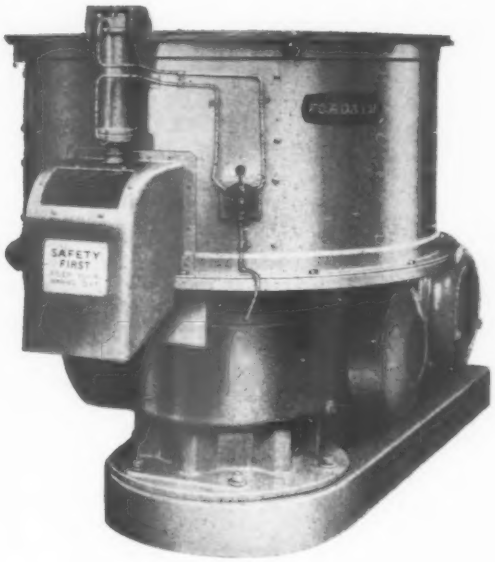

For mixing mixtures with meticulous requirements there is nothing to compare with the Fordath Mixer (8 models with batch capacities from 1 ton to 2 pounds). Designed and patented by Fordath, this machine was produced originally to mix various sands and bonding compounds for core-making in the foundry. Now it has been discovered by industry at large and is in daily use —here, there and everywhere—mixing powders of all kinds, with or without liquid bonding material; e.g. for glue, fibrous materials, asbestos insulating materials, abrasives, fluxes for welding electrodes, etc. etc.

So that you, too, may produce thoroughly blended mixtures,
ASK YOUR PEOPLE TO ENQUIRE ABOUT THE

FORDATH mixer

THE FORDATH ENGINEERING CO., LTD., BRANDON WAY, WEST BROMWICH, STAFFS
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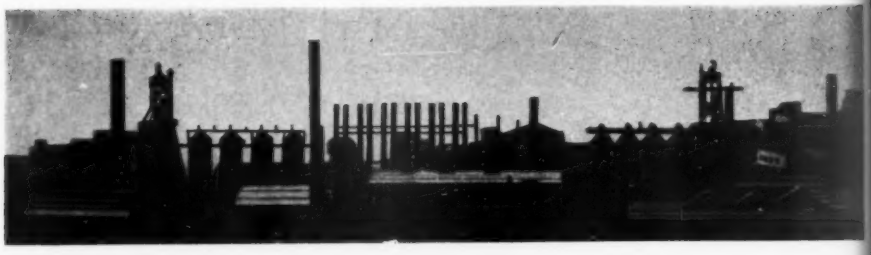
10208

Question which type of dust collection and control plant?



Answer consult Holmes

We have specialised in the design, manufacture and installation of dust collection and control plant for a good many years and today our range is second to none. Plant manufactured by our Gas Cleaning Division includes: Holmes-Elex Electrical Precipitators: Holmes Retroflux and Standard Bag Filters: the Holmes Schneible Multi-Wash System: Holmes-Rothemuhle Multi-Cell Cyclone Dust Collectors and Trion Electronic Air Filters. Enquiries normally entail visits to site by an engineer from our Test and Process Development Section to assess the particular problems involved and their solution in terms of the comprehensive range of plant which is available. Extensive laboratory facilities exist for the examination of dust and fumes, and, where necessary, arrangements can be made for pilot plant to be installed for trial purposes. Detailed technical brochures on all types of plant are available and can be had on request.

W. C. HOLMES & CO. LTD.

Gas Cleaning Division
Turnbridge, Huddersfield

Telephones: Huddersfield 5280
London: Victoria 9971
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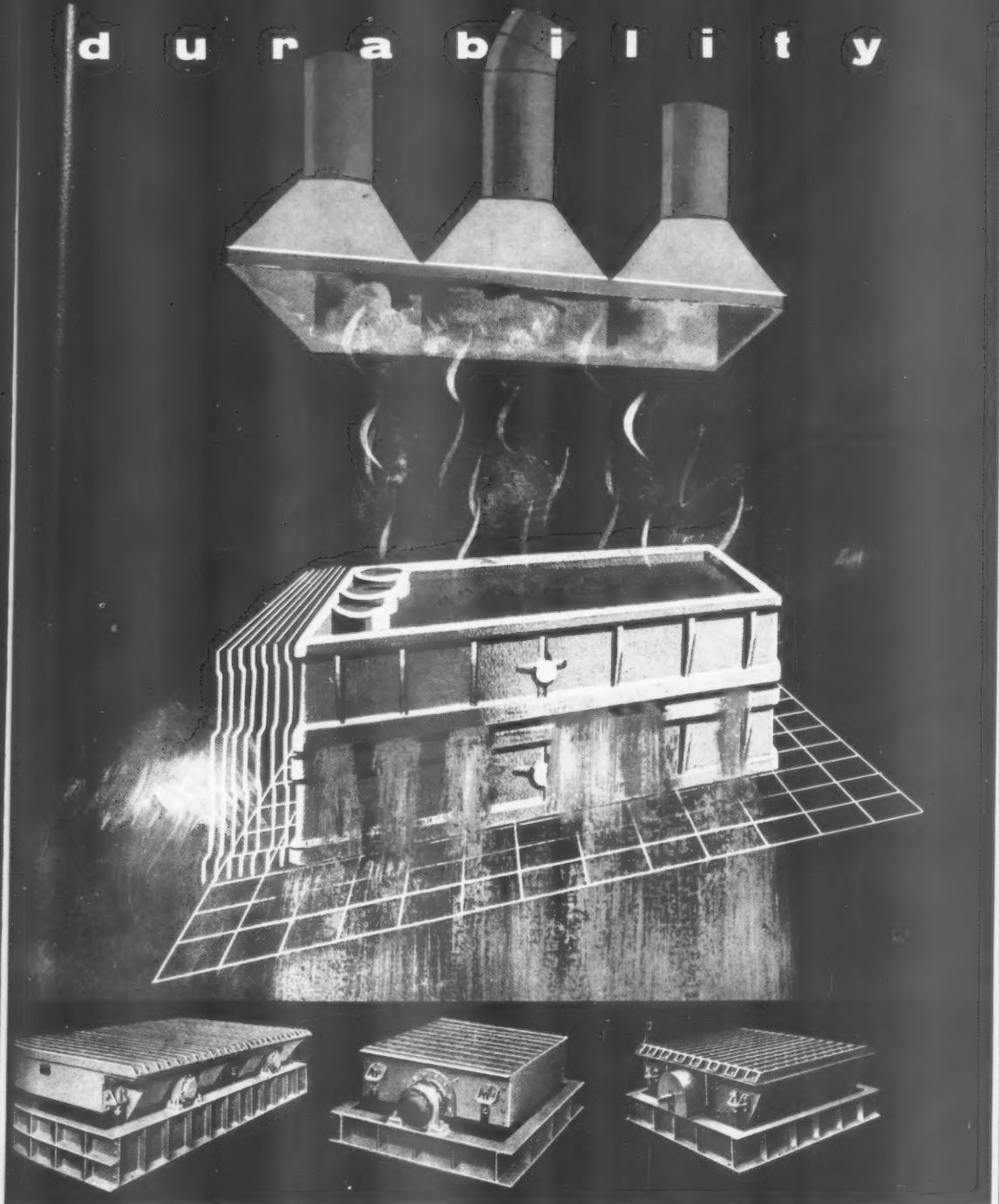
1960

d u r a b i l i t y



Solid ribbed hot-rolled steel sections re-inforced externally enable these boxes to resist the roughest usage for the maximum period . . . prolonged if a Shakeout Machine is used.

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STANTON low phosphorus foundry pig iron

This iron is machine cast and customers special requirements can be met within the limits of analysis shown.

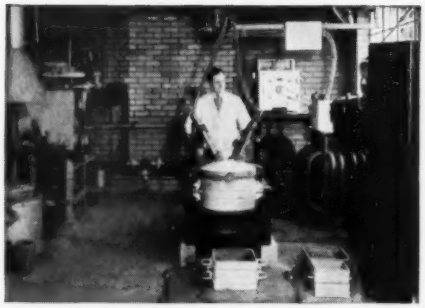
It is particularly suitable for the Automobile Industry and for all High Quality Castings.

ANALYSIS	**Total Carbon**	**3·4% min.**
	Silicon	**2·0–4·5%**
		(in ranges of ·5%)
	Manganese	**0·7–1·1%**
	Sulphur	**0·05% max.**
	Phosphorus	**0·25 % max.**

A free and confidential metallurgical service is offered to customers in all aspects of foundry practice and technique.

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

If you have a SAND CASTING PROBLEM 'FULBOND' may well be the solution!



A MEMBER OF THE LAPORTE GROUP

We invite you at any time to call on the services of our experimental foundry and sand-testing laboratory. Our foundry technicians will be pleased to co-operate in helping you find the solution to sand casting problems. Or if you prefer, they can come to your foundry to discuss a particular difficulty on the spot. These Fulbond services are offered without charge. All details are, of course, treated in strict confidence.

Just telephone or write to

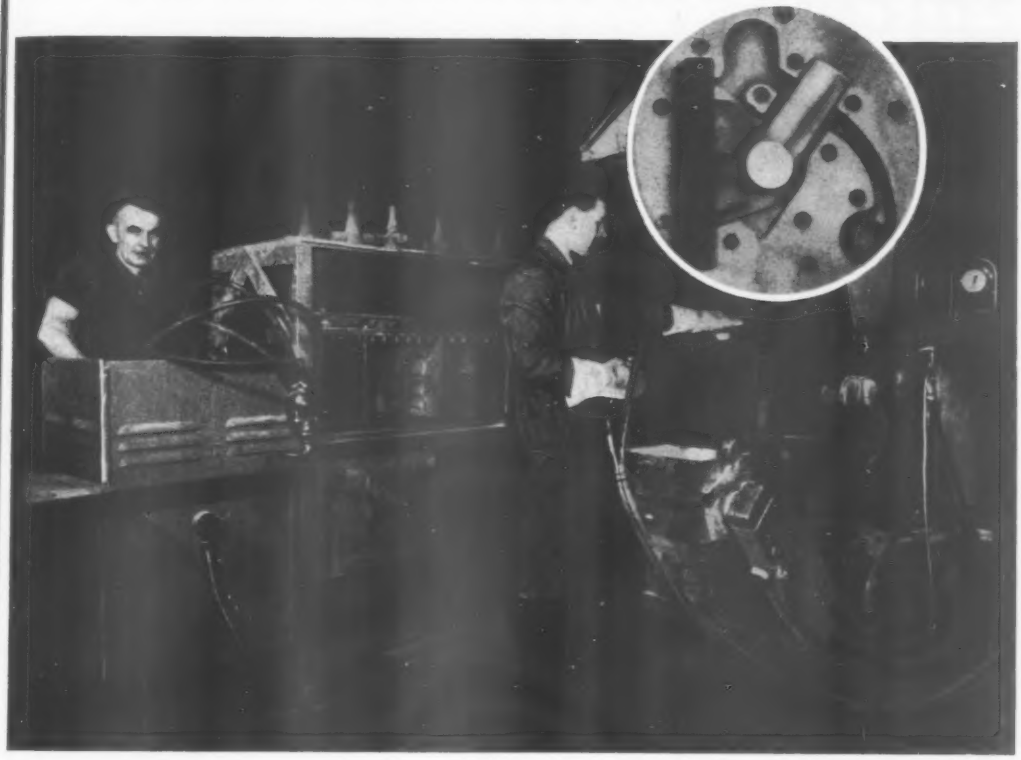
THE FULLERS' EARTH UNION LTD.

Patteson Court, Nutfield Road, Redhill, Surrey

Telephone: Redhill 3521

CMF 50A

Another Polygram Installation at A.P.V.-Paramount Limited



Photograph of a section of the POLYGRAM Shell Moulding equipment installed at A.P.V.-Paramount Ltd., Crawley, Sussex.

A.P.V.-Paramount Ltd. obtain substantial cost reductions and machining economies Shell Moulding a wide range of stainless steel components for the Chemical, Brewery and Allied Industries.

Any information you may require concerning the world-famous range of precision built POLYGRAM Shell Moulding Machines and Equipment as supplied to principal foundries in Britain and the Commonwealth, The Ministry of Supply and the Crown Agents for oversea Governments and Administrations will be forwarded on request.

One of the Shell Moulded stainless steel castings incorporated in the manufacture of a Heat Exchanger. Photographs by Courtesy of A.P.V.-Paramount Ltd.

Polygram Casting Company have a competent and complete service to offer and your enquiries are invited.

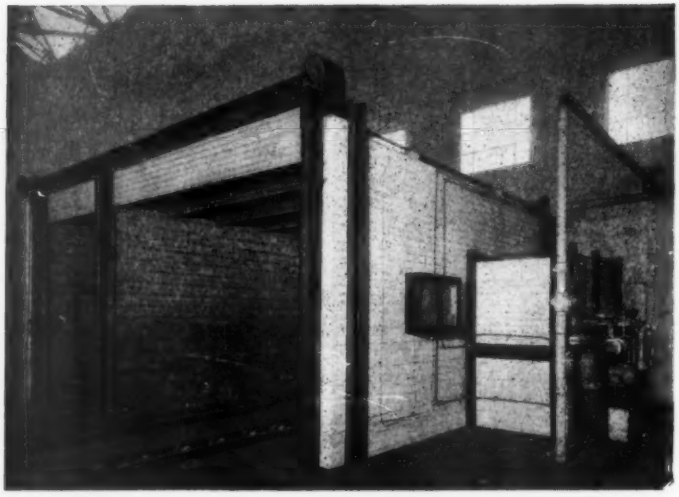
Polygram Casting Company have a competent and complete service to offer and your enquiries are invited.

Polygram

FIRST NAME IN SHELL MOULDING

Polygram Casting Company Limited, Shernfold Park, Frant, Tunbridge Wells, Kent. Telephone Frant 346 (5 lines)

Greater all-round efficiency . . .



"NEWSTAD" Core and Mould Drying Stoves gas-fired

Photo by courtesy of Messrs. John Hill & Son (Ironfounders) Ltd. (Branch of the Staveley Group)

Economical and constant performance ensured by automatic control and full safety protection. Clean and highly efficient in operation. These stoves combine the advantages of our well-known Newstad recirculation system with full automatic temperature control, flame failure and electrical failure protection, and conform to all the requirements of the regulations governing foundry conditions. Also available "Junior" small oil-fired portable Mould Dryer, Sand Dryers, etc.

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Builders of INDUSTRIAL FURNACES

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COMMONWEALTH AGENTS

Forest Engineering (PTY.) Ltd. P.O. Box 6738 Johannesburg, South Africa.

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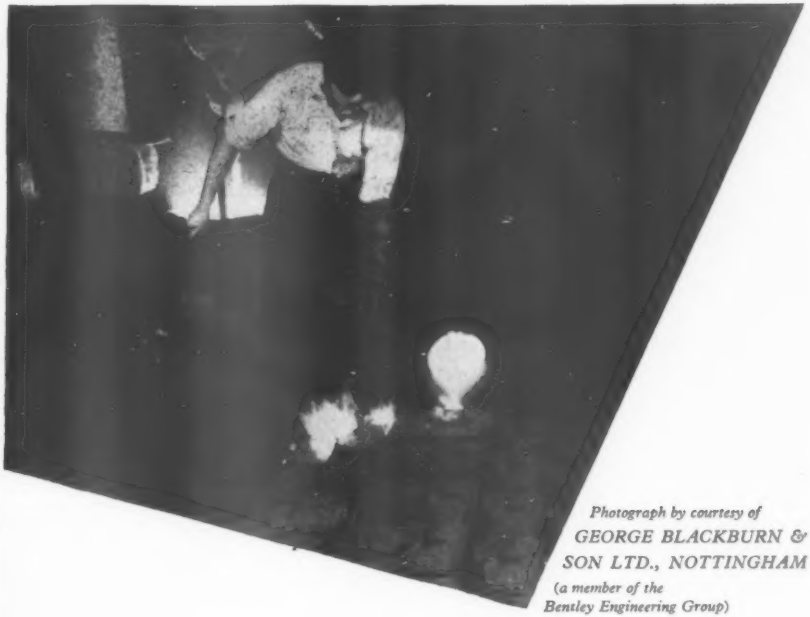
BIS *can help with your Sand problems*



Photograph by courtesy of
GEORGE BLACKBURN & SON LTD., NOTTINGHAM
(a member of the Bentley Engineering Group)

These leaflets may interest you— they will be sent free on request

BRITISH INDUSTRIAL SAND LIMITED · FESLENTE LIMITED
Producers of Industrial Silica Sands *Resin-coated Sands*
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SINCE 1947

ONE WALSALL FOUNDRY HAS PURCHASED 2,950 PAIRS OF 'TALBARD' MOULDING BOXES.
A LARGE NUMBER OF THESE BOXES WERE MADE WITH ONLY ·003" PIN CLEARANCE.
OUR CUSTOMERS ASSURE US OF THEIR COMPLETE SATISFACTION—

WHY?

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MANUFACTURERS OF "TALBARD" MOULDING BOXES
TALBARD WORKS
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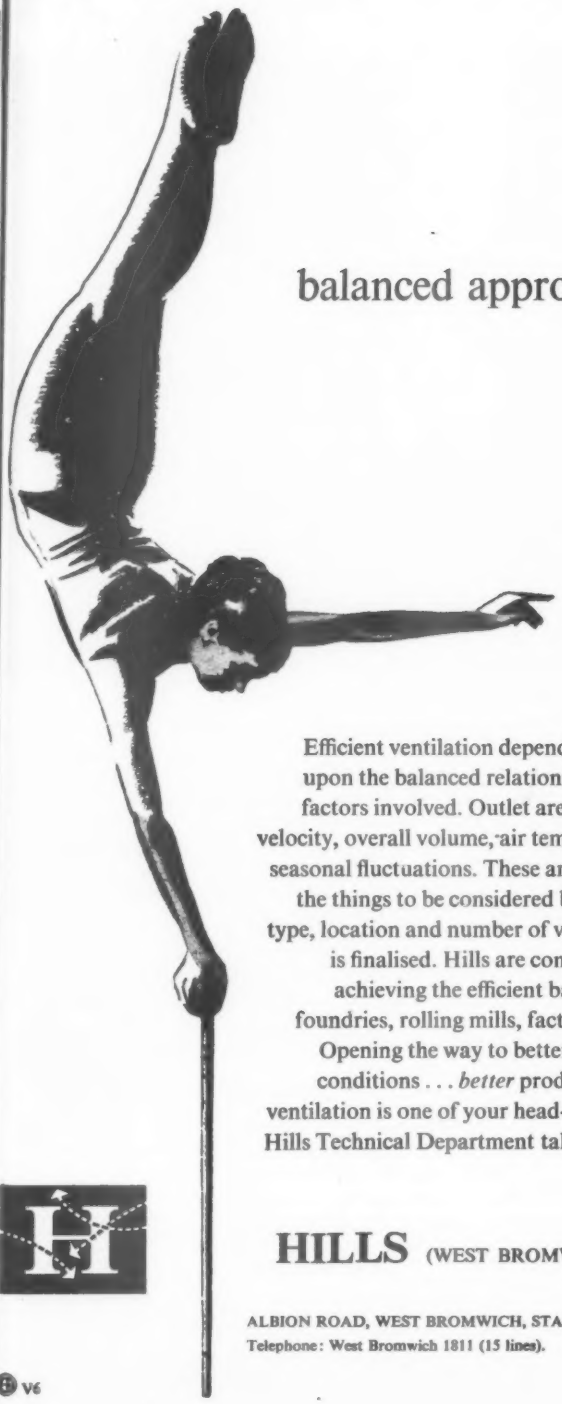

balanced approach to ventilation

Roof ventilating shutters.

Louvred air inlet ventilators.

Efficient ventilation depends directly upon the balanced relationship of all factors involved. Outlet area, airflow velocity, overall volume, air temperature, seasonal fluctuations. These are some of the things to be considered before the type, location and number of ventilators is finalised. Hills are continuously achieving the efficient balance for foundries, rolling mills, factories, etc. Opening the way to better working conditions . . . *better* production. If ventilation is one of your head-aches, let Hills Technical Department take it over.

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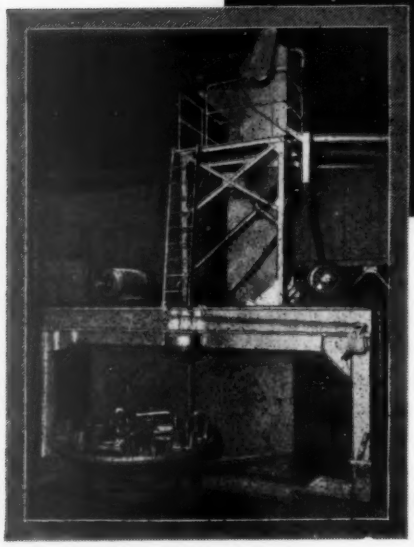
V6

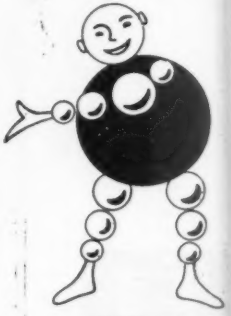
TILGHMAN'S Dual Swing Table Wheelabrator Plant

using W[illegible]



The plant illustrated is a 6ft. Dual Swing Table Wheelabrator installed at Messrs. Jarrow Metal Industries Ltd. It is engaged in cleaning a miscellaneous load of steel castings and the cleaning cycle is eight minutes. This type of plant enables one table to be unloaded and reloaded whilst the other table is under the blast stream and each table is capable of carrying two tons.

LESS THAN FIVE TONS OF STEEL SHOT CONSUMED IN 6 MONTHS



This plant was installed in November, 1956 and in May, 1957 had not used all of the 5 tons of S.460 WHEELABRATOR Steel Shot delivered.
In the first few weeks of operation the machine was working three shifts per day in order to catch up on production, but is now employed on a 44-hour week only. During five weeks of the early period, 250 tons of steel castings were Wheelabrated and maintenance replacements in this time amounted to one set of blades and one deflector plate.

TILGHMAN'S LIMITED · BROADHEATH · ALTRINCHAM · CHESHIRE

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AGENTS: MIDLANDS.—R. J. Richardson & Sons Ltd., Commercial Street, Birmingham, 1.
SCOTLAND.—Balbardie Ltd., 227, Bath Street, Glasgow, C.2; 110, Hanover Street, Edinburgh 2.
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W161

14, 1960
Plant
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"BROOMWADE" presents

NEW Two-Stage Double-acting Stationary Air Compressor of Advanced Design

Type L2000

★ COMPACT DESIGN
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★ ALL-ROUND ECONOMY
★ COMPLETE RELIABILITY

The result of long research and development, the L 2000 has been subjected to exhaustive tests which have proved most satisfactory.

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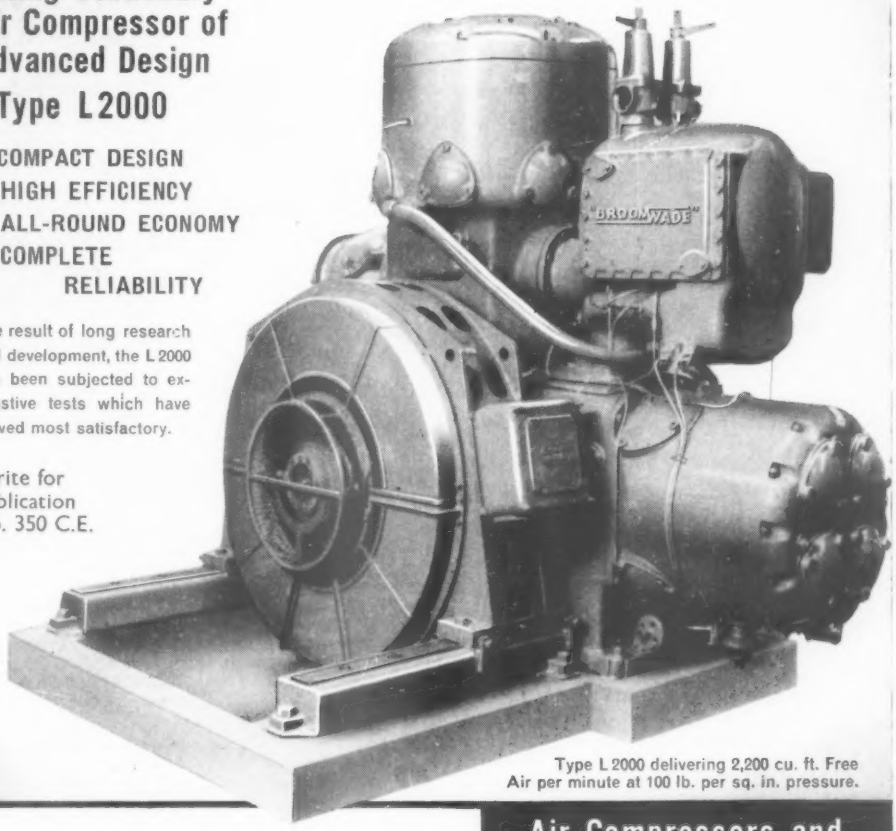

Type L 2000 delivering 2,200 cu. ft. Free Air per minute at 100 lb. per sq. in. pressure.

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YOUR BEST INVESTMENT

BROOM & WADE LTD., P.O. BOX No. 7, HIGH WYCOMBE, ENGLAND
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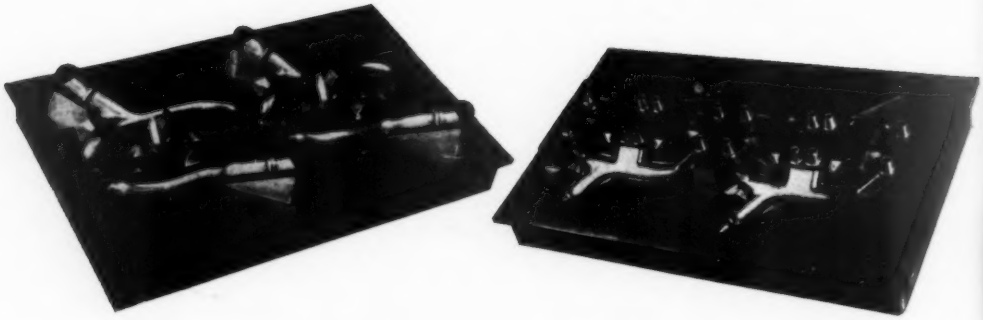
UNBEATABLE!

PRESSURE by CAST



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Designers and Manufacturers of Pattern Equipment by Craftsmen who know every phase of Pattern Making and have practised it to its Finest Skill. Our DRAWING OFFICE FACILITIES, TECHNICAL CONSULTANT SERVICE, and above all SPECIALISED MACHINERY and MODERN EQUIPMENT assure maximum economy in every step of the procedure.

This is why leading manufacturers rely on us for the utmost accuracy, economy and production technique in Wood and Metal Pattern Equipment engineered to fit the needs of your foundry.

Expert Pattern Moulders in our own Foundry produce :—PRESSURE CAST COPE and DRAG PLATES, **SINGLE** AND DOUBLE SIDED MATCH PLATES in ALUMINIUM & BRONZE, SHELL MOULDED PATTERN EQUIPMENT. EPOXY RESIN AND ALL TYPES OF WOOD AND METAL PATTERN EQUIPMENT for the Engineering, Automobile, Aircraft, Electrical, Marine, Shipbuilding and Allied Trades.

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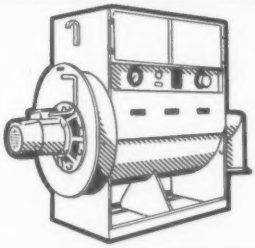
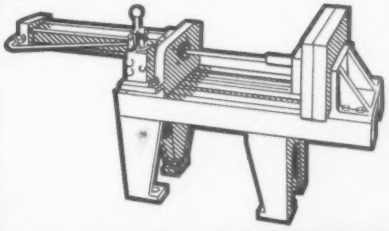
EFCO-BROWN BOVERI MOULD DRIERS

Portable electric mould driers to give quicker and more efficient drying by forcing hot air through the sand. Drying costs cut by 30%.



GRAVITY DIE CASTING MACHINE

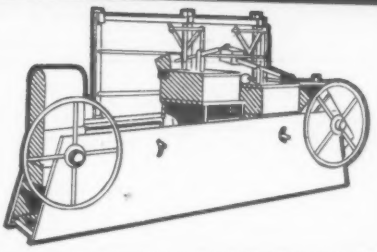
A simple machine for low cost production of castings which do not need to be made within strict dimensional tolerances. Dies cost 70%-75% less than orthodox dies.



..... Foundry Equipment

SHELL MOULDING MACHINE

A manually operated machine for making good moulds consistently in sizes up to 18in. by 14in. Power consumption is only 13 kW.



SHELL MOULD CLOSING MACHINE

A new-type patented press giving rapid, positive closing of shells using a thermo-setting adhesive. Closing time can be only 30 seconds with 100 moulds being closed an hour.

INTERNATIONAL MACHINE TOOL EXHIBITION 1960
June 25-July 8
Olympia-London
STAND No. 6
GRAND HALL

Enquiries invited for gas and oil fired melting furnaces, heat treatment furnaces, core blowers and all types of mould and core drying ovens.

EFCO-DIAMOND ROTARY REACTOR

A new method of desulphurising iron and steel, developed in U.S.A. by Diamond Alkali Company. The desulphurising process is efficient and easily operated, using inexpensive re-agents. Reactors can be supplied for batch and continuous production, for outputs of 5 tons or more an hour.

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Ingersoll-Rand

air powered hand tools for industry

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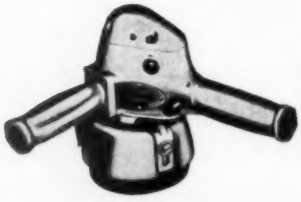

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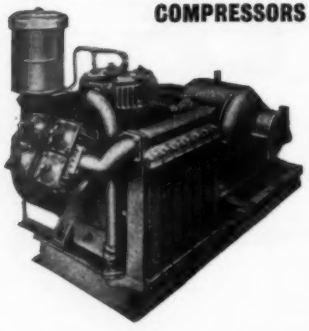

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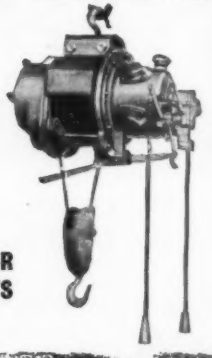

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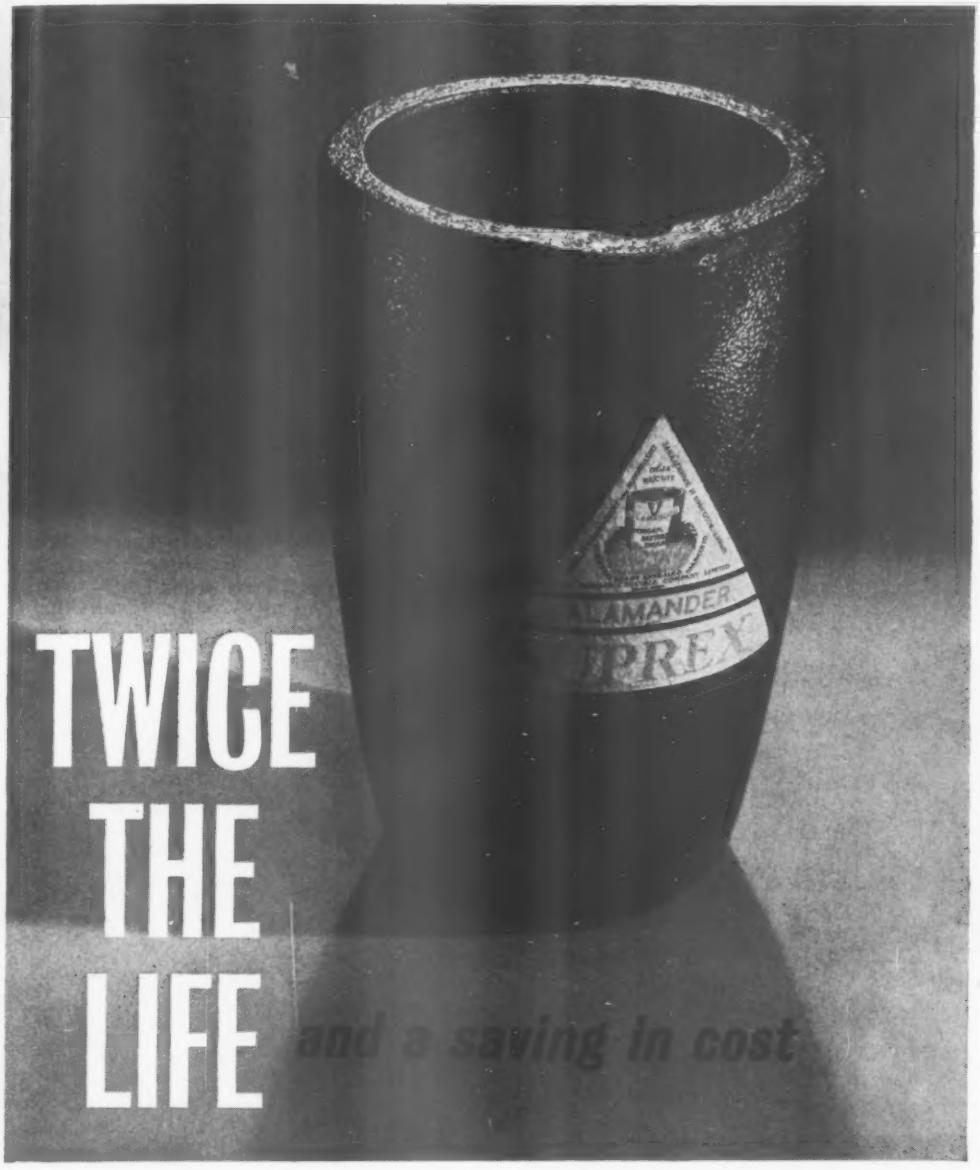

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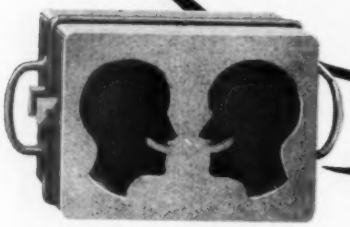

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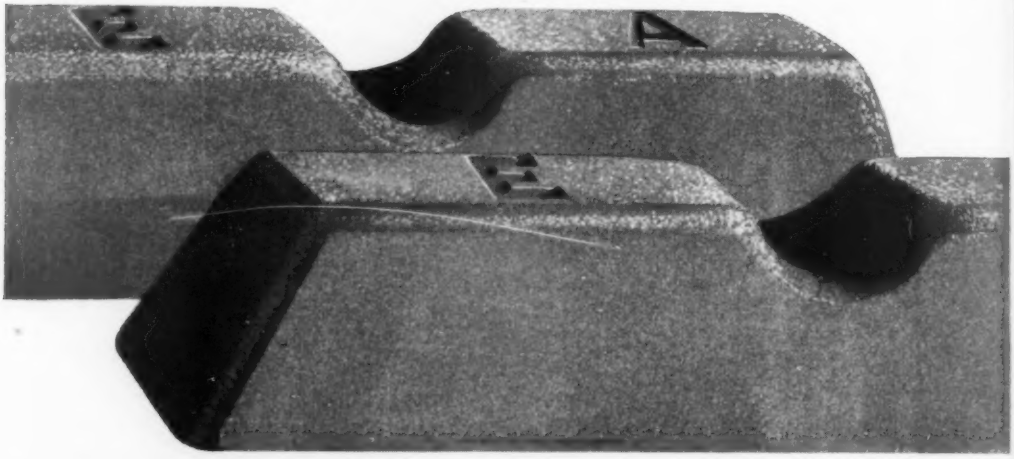

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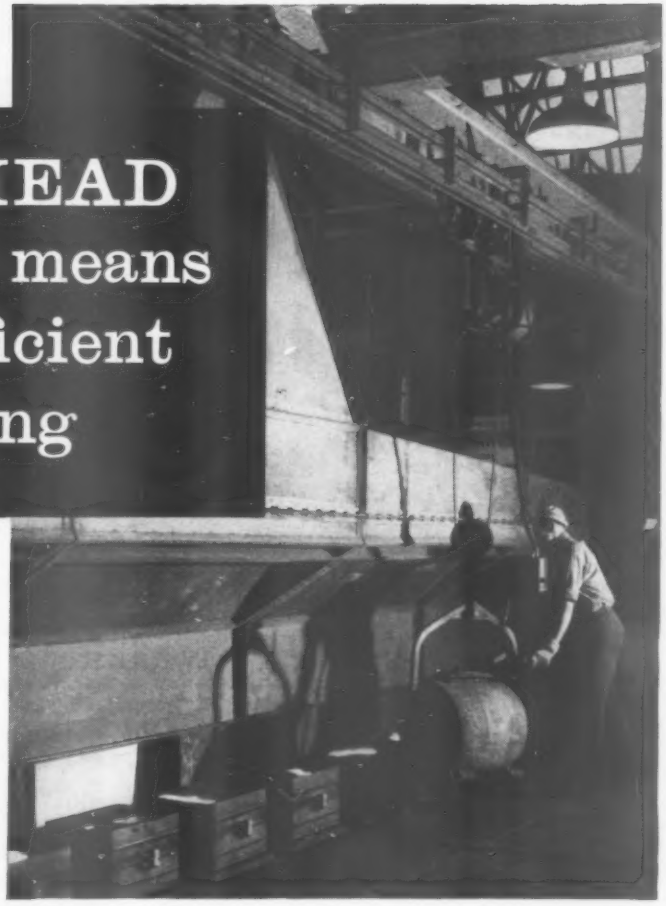

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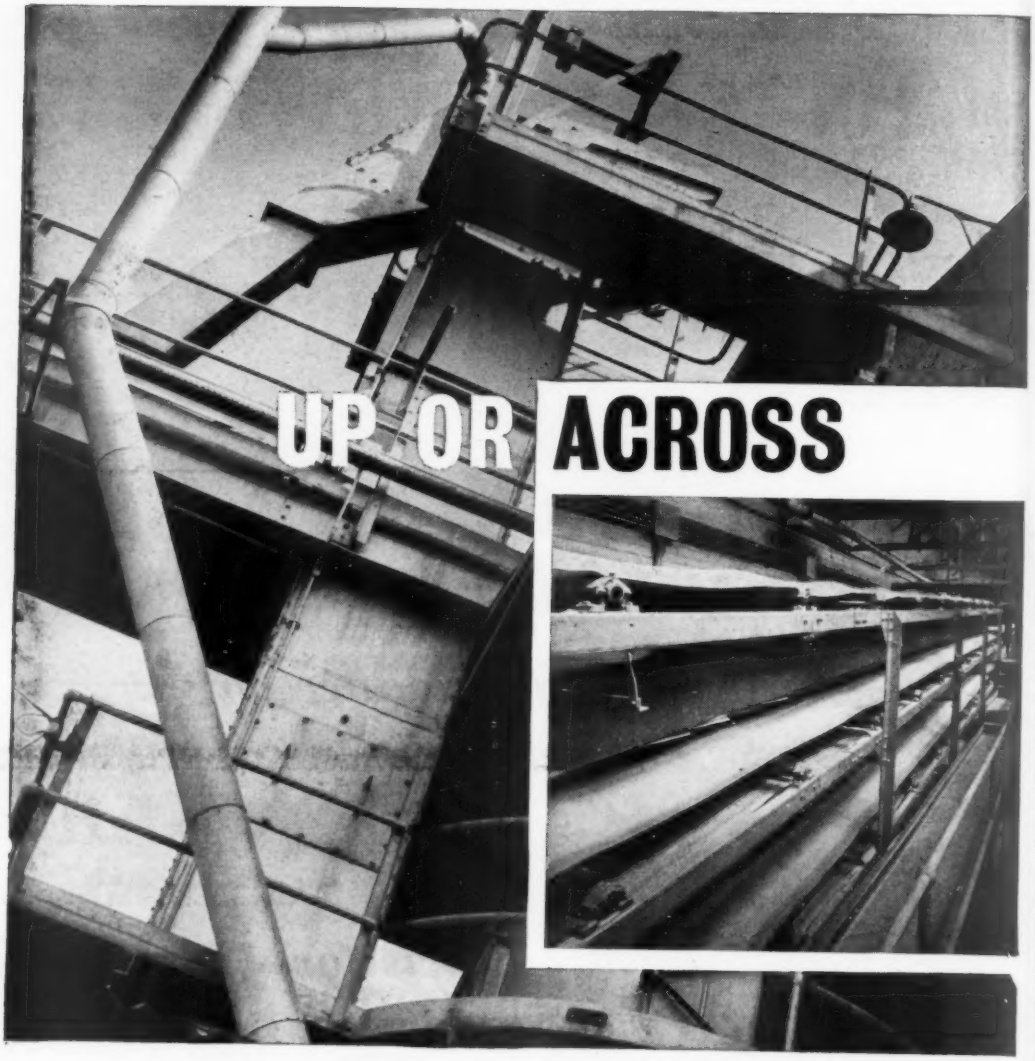

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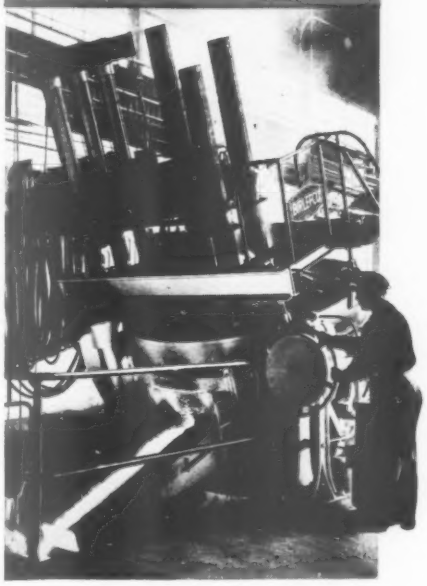

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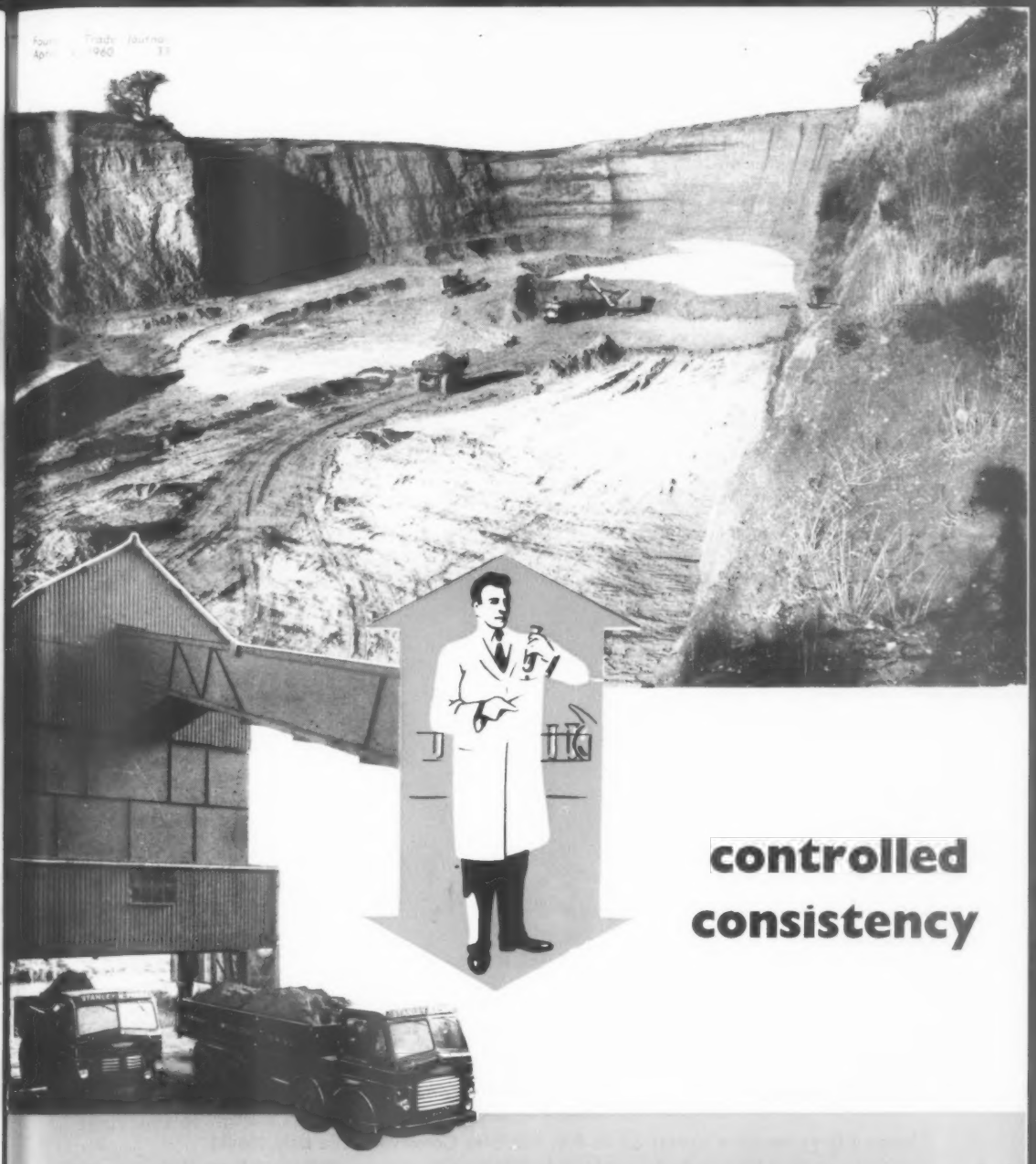

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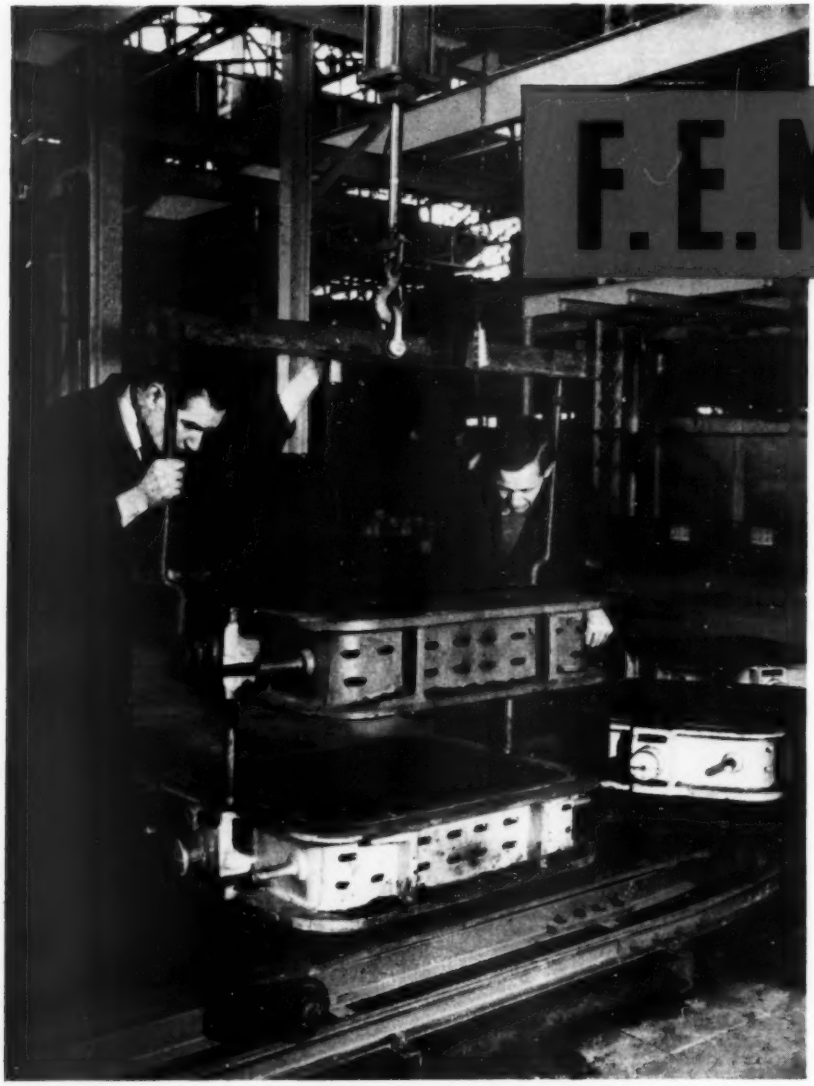

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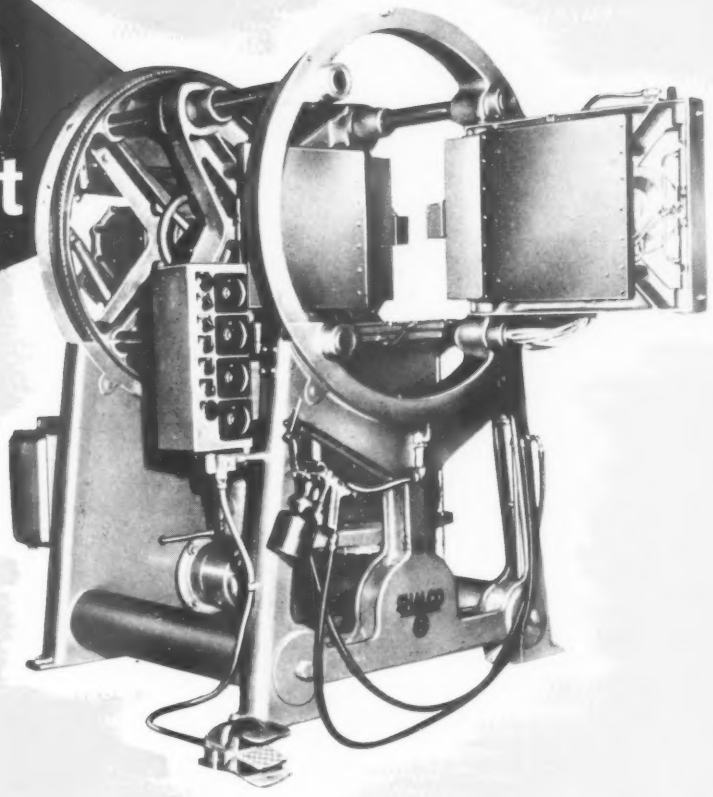

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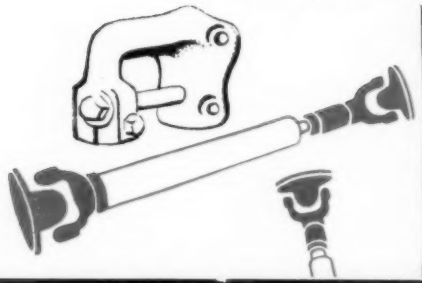

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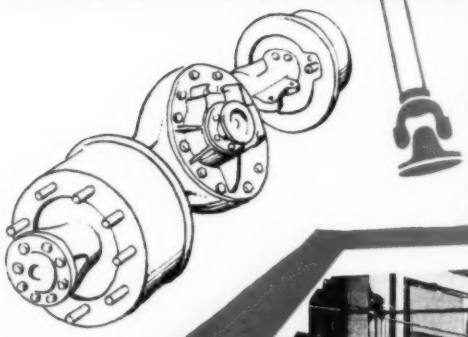

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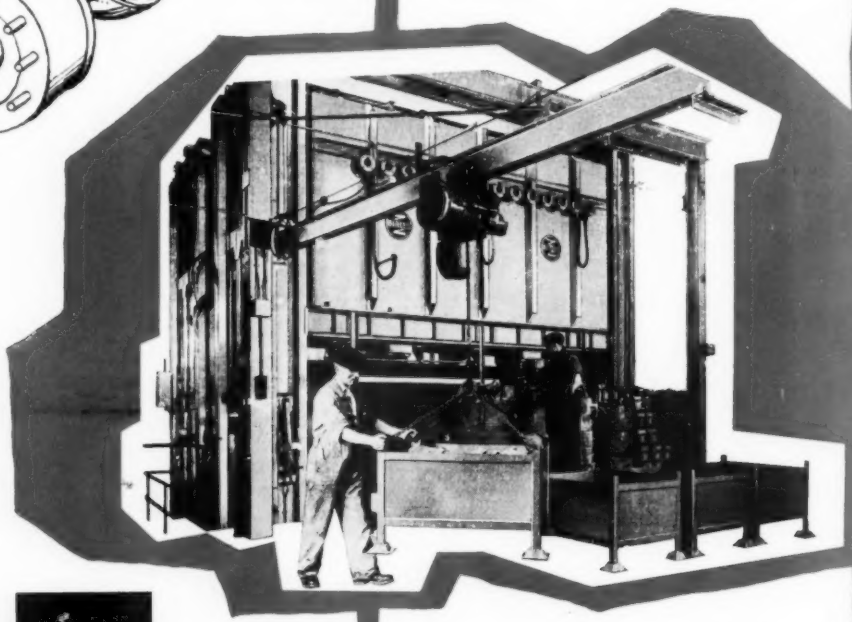

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FOUNDRY TRADE JOURNAL

Vol. 108 April 14, 1960 No. 2262

Established 1902

Incorporating

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Single copy 1s.; by post 1s. 4d. Annual subscription: home 52s., abroad 60s. (prepaid)

Editor:
V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.

Assistant Editor: A. R. PARKES, M.I.B.F.

Commercial Editor: P. E. CARDEN.

Advertising Manager:
F. BARRINGTON HOOPER, B.A.

Production Manager:
R. J. LOVELL

Publisher: H. J. DWYER

Circulation Manager: E. T. GRIFFITHS

District Representatives:
G. P. ELLIOTT (Northern Area) 'phone: Altrincham 1334

T. H. SMITH (Scotland) 'phone: Dumbarton 1046

D. C. RYALL (Southern Area) 'phone: TRAfalgar 6171

The FOUNDRY TRADE JOURNAL is the official organ of the British Steel Founders' Association; Association of Bronze & Brass Founders; the Light Metal Founders Association; Foundry Trades' Equipment & Supplies Association and the National Society of Master Patternmakers.

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Published Every Thursday by Industrial Newspapers, Limited

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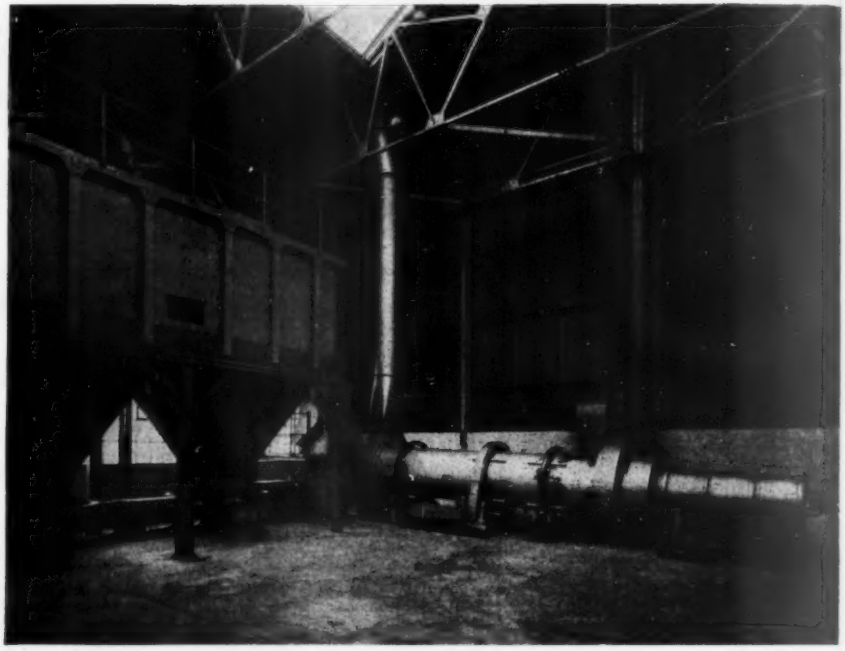

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FOUNDRY
TRADE JOURNAL

Vol. 108 April 14, 1960 No. 2262

The New Age of Specialization

The foundry employment situation, as revealed by a search through the small advertisements appearing in the FOUNDRY TRADE JOURNAL over the last 30 years, is indeed illuminating. At the beginning of this period, 1930, it would appear that the human make-up of foundries consisted of boards of directors, the owners, foundry managers, foremen, moulders, coremakers, patternmakers, fettlers and furnacemen. Occasionally, a metallurgist or a chemist was wanted, but rarely. The most-sought-after man was a good cupola attendant, and a rather interesting deduction could be that the quality of the production of many iron foundries depended upon the skill of this one man. In those years, the number of situations wanted usually exceeded those vacant. Yet ten years' later, such was the scarcity of personnel that labour movement was largely by Government direction, a situation which persisted for another five years.

By 1950, requests were noted for estimators, whilst some advertisers politely printed little notices thanking applicants and telling them that such and such a position was now filled. Five years' later, new types of positions were advertised, the major one being for supervisors—in numbers which have expanded ever since. Unfortunately, one can never be sure whether a supervisor is above or below a foreman. With this change came requests for applicants to fill the positions of maintenance and production engineers, as by that time the mechanized production of castings was well established. Still, the real impact of Parkinson's Law had not been felt.

This year's (1960) requirements for foundry staff include, *inter alia*, works engineers, physicists, works managers, production engineers (now sub-divided into managers and superintendents), sand-control technologists, site engineers and sub-divisions of metallurgists. This by no means is a complete list, for there are personnel managers, accident-prevention officers, inspectors, X-ray technologists, and technicians. Thus, it is evident that the staffing of the foundry industry has changed from a neat, easily understood organization, to one of ever-increasing complexity. Yet through the whole period surveyed, two requirements are ever present—the highly-skilled moulder and the qualified patternmaker. Historically, the first advertisement for staff ever printed in the JOURNAL read " Wanted, foreman moulder. Apply Charles D. Phillips, Emlyn Foundry, Gloucester." It appeared in the issue of 1902 and as an example of simplicity and economy of words could hardly be bettered provided the applicant was right in assessing the foundry to be a jobbing shop, during both iron and non-ferrous work.

European Foundry Apprentice Competition

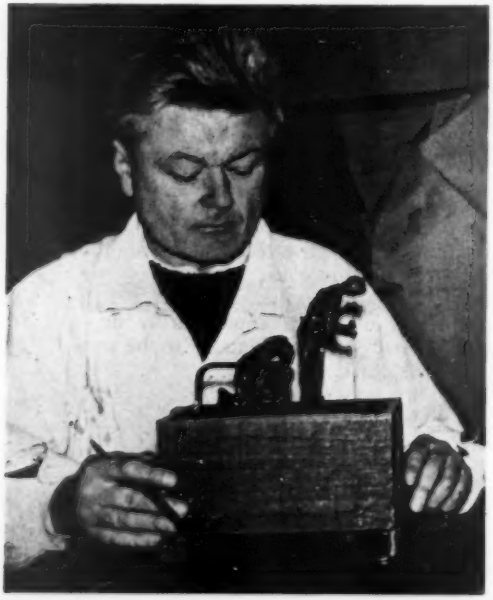
The apprentices to represent Britain in the European Foundry Apprentice Competition in Wolverhampton and Wednesbury during the week May 23 to 27 have now been chosen. They are:—T. J. Vincent of Hamworthy Engineering, Limited, iron and non-ferrous founders, Poole, Dorset; R. Morley of Bradley & Foster, Limited, ironfounders and refined-iron makers, Darlaston, Staffs; and C. F. Corbett, F. H. Lloyd & Company, Limited, steelfounders, Wednesbury, Staffs. W. N. Styles of W. & T. Avery, Limited, Tamebridge, Walsall, Staffs, is the team's reserve.

These young foundrymen—none is more than 20—have been chosen as the result of a national competition conducted by the Institute of British Foundrymen. They will be competing against other apprentices from a number of Western European countries in the third annual competition to decide which is the best foundry apprentice and which nation has the best team of young foundry workers.

It is interesting to record that two out of the three team members—Mr. Morley, Mr. Corbett and Mr. Styles respectively—are third-year students at the County Technical College, Wednesbury. The College staff and other students can justifiably take pride in this fine achievement.

Foundry Apprentice Trophy

The illustration reproduced below is of particular interest in connection with the above. Here Mr. Leslie Durbin, M.V.O., is shown at work in his North London studio, preparing the model of the bronze trophy for the European Foundry Apprentice Competition. His clients have included the Queen Mother, and the Singapore Assembly—for whom he made the mace for Singapore's legislators.



Luncheon

LIGHT METAL FOUNDERS' ASSOCIATION

The annual luncheon of the Light Metal Founders' Association was held at the Savoy Hotel, London, on April 6. Mr. W. Brown, the chairman of the Association, presided. The chief guest was Mr. Geoffrey Rippon, M.P. (Parliamentary Secretary to the Ministry of Aviation). His toast to the Association was replied to by Mr. S. E. Clotworthy, C.B.E. Mr. H. G. Herrington, C.B.E., proposed the toast to "The Guests" to which Mr. G. L. Bailey, C.B.E., M.SC., the director of the British Non-Ferrous Metals Research Association, replied. Amongst those present were Mr. L. Fletcher; Mr. N. P. Newman, C.B.E. (president of the Joint Iron Council); Mr. Arthur Jennings, M.A. (the Master of the Worshipful Company of Founders); Mr. A. J. N. Brown (president, Association of Bronze & Brass Founders); Mr. B. Levy (of the National Association of Master Patternmakers); Mr. R. Carr, M.P.; Dr. J. G. Pearce, C.B.E., and Mr. T. H. Summerson, D.L. (of the British Steel Founders' Association).

Forty Years Ago

The first article ever to be printed in the JOURNAL on "The Human Element in Industry" appeared in the April, 1920, issue. It was a paper by Mr. H. Mensforth (later Sir Holbury Mensforth). Much too much has been written on the subject since, but few articles have contained more useful matter. The author suggested *inter alia* the appointment of personnel officers—he called the post "employment manager"—and also the creation of joint works councils. He confessed that attempts to make foremen and supervisors out of drawing-office staff had, for some unknown reason, been a failure. To-day many of his suggestions are just normal practice.

This issue also contained a record of a 14-ton iron casting which was then being made in South Africa. Amongst "New Companies" listed appeared the names of the Bradford Piston Ring & Engineering Company, Limited; Stones, Wilkinson & Company, Limited; Tweedales & Smalley, Limited; James Gibbons, Limited, and Spermolin, Limited.

Forthcoming Events

APRIL 20

Institution of Production Engineers

Peterborough section: "Radio-isotopes in Engineering," by W. D. Busbridge, 7.30 p.m., in the Conference Room, Peterscourt, Peterborough.

APRIL 21

Institution of Plant Engineers

"Modern Electric Space-heating," by W. N. Shires, 7.30 p.m., in the Castle Hotel, Blackburn.

Institute of Vitreous Enamellers

Northern section: "Direct Enamelling on Steel," by S. E. A. Ryder, 7.30 p.m., at the Old Nag's Head, Deansgate, Manchester.

APRIL 22

Institute of British Foundrymen

Bristol & West of England branch: Annual general meeting, 7.30 p.m., at the Royal Hotel, Bristol.

APRIL 23

Institution of Production Engineers

North Midlands region: One-day conference on "The Production Engineer in a Changing Economy," 9.30 a.m., in the Welfare Hall, Rolls-Royce, Limited, Derby.

MAY 10

Institute of British Foundrymen

Coventry and district section: Casting makers and users' forum: No. 1—The Aircraft Industry. Questions to be submitted by May 3 in writing to the secretary, Mr. M. R. J. Evans, 48, Stewart Street, Nuneaton. The meeting will be held at Sterling Metals, Limited, Gipsy Lane, Nuneaton.

Platinum-Platinum/Rhodium Thermocouples for Temperature Measurement in the Foundry

*By E. R. Perry**

With the development of the latest types of ferrous and non-ferrous alloys, in the production of which close control is essential, increasing attention has been focused in recent years on methods of temperature measurement. While it is generally accepted that close control is necessary if optimum properties are to be obtained with the newer alloys, it is not so widely appreciated that in the case of many of the "traditional" alloys also major advantages are gained by consistent use of temperatures which have previously been determined as most suitable for the respective types. The following article is in the nature of a review of current pyrometry practice, and mention is also made of the development of a rare-metal thermocouple of improved strength.

There are few places where frequent resort to use of a pyrometer will not aid the production of castings of high quality, thus effecting substantial economies because less material has to be scrapped due to defects which result from inadequate temperature control. The use of pyrometers has become increasingly recognized as essential by English metallurgists, in both the ferrous metal and the non-ferrous foundries, for these reasons:

Melting losses: are kept to a minimum by rapid heating and holding at temperatures for as short a time as is possible before pouring. Time at temperature is governed by any treatment to be given to the molten metal, and the use of a pyrometer gives an immediate indication when this temperature is reached. Similarly, after the treatment is completed, the pyrometer reading shows, without delay, when the temperature has reached the stage at which the metal can be poured. As a result of such control, the metal is neither overheated nor held at temperature for longer than is necessary.

Scavenging: When a melt is scavenged with a gas such as nitrogen, too low a temperature may result in failure of the gas to bubble through the molten bath. If, however, the temperature is too high, it is possible that the bath will pick up contaminating gases from the atmosphere at a greater rate than they can be removed by the scavenging medium.

Additions to Melts: In many cases, additions of other constituents are added to the basis melt before casting. If the additions are made at an unsuitable temperature, the addition elements may not become thoroughly dissolved in the parent metal; they may volatize, or oxidize, and enter the slag, and the final composition of the metal will consequently not be that desired.

Superheat: To develop optimum properties in the cast metal, it is necessary, with many alloys, to superheat the molten metal prior to pouring. The superheat treatment has usually been selected as the result of precise experimental work, and the use of a pyrometer ensures that the optimum temperature is actually attained.

Pouring Temperature: The importance of pouring temperature needs no re-emphasis; it should be such that the solidified casting will have the desired metallurgical properties as regards grain size, freedom from segregation, strength, etc., and it must be at a level which will ensure that the molten alloy has adequate fluidity, *i.e.*, ability to run and give accurate reproduction of mould contour. Among factors affecting the pouring temperature are: the melting range of the alloy; the type of the mould (refractory or metal) into which it is to be cast, and the intricacy of the mould cavity. For example, if the metal is cast at a temperature higher than is necessary it takes longer to freeze in the mould, and excessive grain growth and shrinkage cavities may result. Alternatively, if pouring is at too low a temperature it is likely that the mould will not be completely filled, and the casting may have to be scrapped.

Three main types of pyrometer[1] are available for measurement of high temperature, namely, optical, radiation, and thermocouple pyrometers. Thermocouple pyrometers are suitable for measuring the temperature of molten metal to an accuracy of better than 10 deg. C.; the other types are normally acceptable only for recording the temperatures of furnace walls and roofs. If the latter are used for measuring the temperature of molten metals, errors ranging up to 200 deg. C. can arise, due to: differences in emissivity between the metal and its slag or oxide; clouding of the sighting windows by smoke or metal vapour, and in the case of optical pyrometers, to the human element. Markedly different readings have been reported by different men using the same instrument. Such errors, however, do not always occur, and the[a] will be much reduced by operating under "black body" conditions, which, though difficult [eg.][2]

* The author is attached to Mond Nickel Company, Limited.

Platinum-Platinum/Rhodium Thermocouples

achieve, can be ideally obtained by sighting on an object, in uniform temperature surroundings, through a small aperture.

Wall-mounted Indicators

In view of the difficulties inherent in other methods of temperature measurement, the recent trend has been to adopt thermocouple pyrometers, and instal wall-mounted indicators served by a number of thermocouples stationed at convenient places throughout the foundry (a typical arrangement is illustrated in Fig. 1). The indicators, which are mounted away from danger of damage, fumes, dust or heat, usually have a potentiometric circuit and are robust, with quick-response characteristics. Owing to the potentiometric nature of the circuit the instrument is not unduly sensitive to poor contacts, and the thermocouple can therefore be used where junction boxes include plug-in points. Although the present trend is to prefer potentiometers, many foundries have had wall-mounted millivoltmeters in use for a number of years, and these have given excellent service.

Platinum Thermocouple Metals

In view of the high temperatures involved, the only acceptable thermocouples are made from the platinum metals. At first sight these are costly, but experience has proved on innumerable occasions that the service rendered by having an efficient and accurate temperature-measuring system far outweighs the initial price of instrumentation. Furthermore, by regular attention, there should be no loss of the platinum metals, and consequently the only charge on the foundry is for reprocessing the pieces of thermocouples periodically removed from service. In the United Kingdom most foundrymen use platinum-platinum/13-per cent. rhodium thermocouples in preference to the platinum-platinum/10-per cent. rhodium thermocouples developed by Henry le Chatelier. Of these two thermocouples, the platinum-platinum/13-per cent. rhodium yields a higher emf. at any temperature, leading to calibration advantages when millivoltmeter instruments are in service. This advantage is reduced on using potentiometer-type indicators; however, in the the interests of standardization, the British foundryman prefers the higher-rhodium-alloy thermocouples. To ensure that the temperature measuring system is always maintained to give accurate results, and to keep losses of platinum thermocouples to a minimum, the usual practice is to make one man responsible for pyrometers. He periodically checks all instruments, calibrates thermocouples and effects minor repairs.

Basic Thermocouple Design

Essentially, the thermo-electric pyrometer consists of two dissimilar wires which form the thermocouple, *e.g., platinum* (negative), and platinum/13-per cent. rhodium (positive). To prevent contact other than at the joint (with consequent short-circuiting), the wires are threaded through fireclay, silica or alumina beads, as shown in Fig. 2. The other ends of the wires—the cold junction—are attached either directly to an indicating instrument

FIG. 1.—*Henry Wiggin & Company, Limited, use platinum-platinum/13-per cent. rhodium thermocouples, and in this photograph one is about to be inserted into an arc-melted nickel-base alloy. In the background can be seen a potentiometric-type instrument capable of indicating temperatures from* 1,000 to 1,750 *deg. C.*

(usually calibrated in deg. Celsius), or connected to it by means of extension wires (compensating leads) which have matching electrical properties. Hence, the platinum wire may be connected to a cupro-nickel alloy, and the platinum/13-per cent. rhodium wire to copper, thus economizing in the amount of precious metal required.

Calibration is based on the difference in emf. between the cold junction at 0 deg. C. and the heated hot junction; Fig. 3 gives this relationship for the platinum—platinum/13-per cent. rhodium thermocouple. Usually an artificial cold junction is incorporated in the instrument, and allowance is automatically made for differences between the room temperature and 0 deg. C. Irrespective of whether the indicator is a deflection-type instrument (millivoltmeter) or a potentiometer, it is essential to ensure that it is not subjected to pronounced variations in temperature, which would cause inaccuracies in the indicated readings.

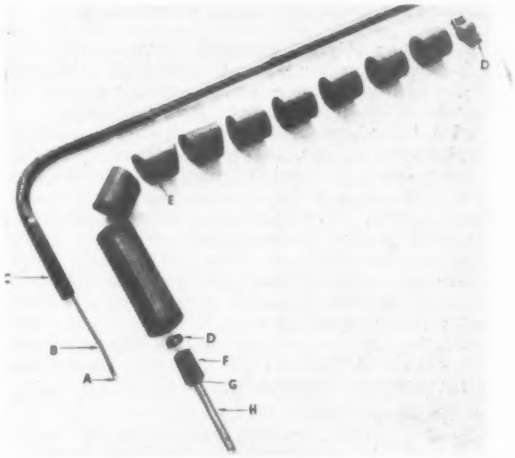


FIG. 2.—*Constructional details of the thermocouple shown in Fig. 1 are illustrated. The hot junction* (A) *is made by twisting platinum-platinum/13-per cent. rhodium wires after threading them through porcelain insulators* (B), *which in turn are threaded through an Inconel tube* (C). *Metal fastenings* (D) *anchor graphite sleeves* (E), *which protect the Inconel tube from the intense heat. A tapered plug* (F), *designed so that it makes a push-fit with the graphite sleeving, is cemented* (G) *to the fused-silica sheath* (H), *which protects the part of the thermocouple which is to be immersed in the molten metal.*

Materials

In order to achieve the required high standards of accuracy in thermocouples, the materials from which they are made must conform to precise standards of composition, physical condition, and properties. The following paragraphs contain a brief review of the requirements which must be satisfied by metals which are to be used for thermocouple manufacture:

Composition: must be consistently uniform, since variation will lead to erroneous results. It is essential that high-purity metals be used and that, in production and processing, precautions be taken to avoid contamination.

Hard-drawn Wires: Thermocouple wires are usually purchased in the hard-drawn condition, and are frequently preferred, as being stronger than wires in the annealed condition; they are more robust, and are unlikely to become mechanically damaged during thermocouple assembly. However, the drawing process sets up some degree of internal stress in the metal, and such stresses may cause errors of up to 5 deg. C. in readings up to 1,500 deg. C. In view of the ease of assembly of wires in the hard-drawn condition many users prefer to accept the responsibility of minor errors, but in cases where absolute accuracy is essential thermocouples must be fully softened before going into service. One method of annealing which has proved satisfactory for platinum—platinum/rhodium couples is to pass an electric current and bring the wires to a bright red heat for five minutes.

Refractory Sheath: Thermocouples should be resistant to oxidation and corrosion. When measuring the temperature of molten metal the couples are protected by a refractory sheath, although this causes some loss in rate of response. Without such protection the molten metal would attack the thermocouple, initially changing the emf. characteristics, and ultimately leading to complete disintegration of the constituent precious-metal wires. In addition, gases such as hydrogen, hydrocarbons, carbon monoxide, etc., may reduce impurities in the slag covering the molten metal, or in refractories used for the crucible or furnace walls, giving rise to carbon, phosphorus, silicon, sulphur, etc., all of which can—if the couple is not protected—attack the platinum, alter the emf. characteristics, and ultimately lead to failure.

Emf. characteristics: must always be consistenly maintained in service, and should be reproducible in different batches of the same alloy. Combinations of base metals may be used up to 1,200 deg. C., but the platinum-platinum/13-per cent. rhodium thermocouple holds a pre-eminent position, and due to its freedom from drift in calibration after a period in service it has come to be preferred in many applications for service below 1,000 deg. C. also. (For temperatures between 1,200 deg. C. and 1,650 deg. C. there is no satisfactory substitute for platinum-platinum/rhodium thermocouples. Whereas platinum-platinum/rhodium thermocouples show little alteration in emf. characteristics even in high-temperature service, it has been observed that heating a Chromel/Alumel thermocouple for 1,000 hours at 1,090 deg. C. resulted in an error of 20 deg.[2]

Platinum-Platinum/Rhodium Thermocouples

Deterioration of this base-metal thermocouple may have been due to contamination through oxidation of the wiring, an effect which would not arise in the case of the precious-metal thermocouples.

When platinum - platinum / rhodium thermocouples are in constant use, as occurs in the foundry, the life of the thermocouple is frequently determined by the resistance of the pure-platinum wire to mechanical stresses which arise on handling—the platinum fails while the platinum/rhodium wire is still serviceable. Such failure results largely from the known mechanical weakness of pure platinum after prolonged heating at high temperatures, an effect which is associated with the excessive grain-growth which must be expected in thermocouple platinum on account of its extremely high purity.

" Fibro-Thermocouple Platinum "

By the use of an entirely new technique, Engelhard Industries, Limited (Baker Platinum Division) have produced thermo-element-quality platinum wires which have a fibrous structure. Such wires show marked resistance to grain growth at elevated temperatures. The new material is designated " Fibro-Thermocouple Platinum." Stress-to-rupture tests carried out by Mond Nickel Company, Limited, on wires of both the fibrous metal and traditional thermocouple materials, showed that at 1,450 deg. C., under a stress of 171 lb. per. sq. in., normal thermocouple platinum fractured after two hours, whereas 300 hours elapsed before the " Fibro-Thermocouple Platinum " failed. Notwithstanding the enhanced mechanical properties, tests have shown the thermoelectric characteristics of this material to be indistinguishable from those of normal thermocouple platinum.

Protection

Because existing refractory materials are attacked by molten metal or slag at very high temperatures, it is not possible to observe continuously the temperature of most of the metals dealt with in this article. For the majority of temperature measurements, however, speed is essential, and the method used is to immerse refractory-sheathed thermocouples into molten metal for only one half to three quarters of a minute. This method was developed by Schofield and Grace.[3]

The refractories used as thermocouple sheaths have to withstand extremely severe conditions. Apart from attack by molten metal, slag and flux, they must have good resistance to thermal shock, reasonable mechanical strength, oxidation- and scaling-resistance, good thermal conductivity and reasonably low thermal capacity, in order to give maximum possible rate of response. Sheaths must also be readily replaceable and inexpensive. Composite sheaths of mullite surrounded by silicon carbide or plumbago have been developed[4] for continuous immersion in molten copper and other alloys, for service up to 1,450 deg. C., but such sheaths are unsuitable for higher temperatures—other types must be used. Fused silica is in service for sheathing thermocouples immersed in steels and the high-nickel/chromium alloys. For white irons, s-g. iron, and non-ferrous alloys other than nickel, the sheath is either fused silica or electrographite. Fused-silica sheaths have much shorter lives than the electrographite ones, but the latter have a much lower rate of response (fused silica 15 to 25 seconds, compared with 25 to 40 second for electrographite). Electrographite is not used in steels or the nickel/chromium alloys because slag attack results in early failure, and there is a danger of carbon from the sheath passing into the molten metal, forming chromium carbides and other unwanted compounds. Common practice is to replace fused-silica sheaths after from one to three immersions, depending on the alloy in which it has been used. Electrographite sheaths are replaced after every 30 or 40 immersions.

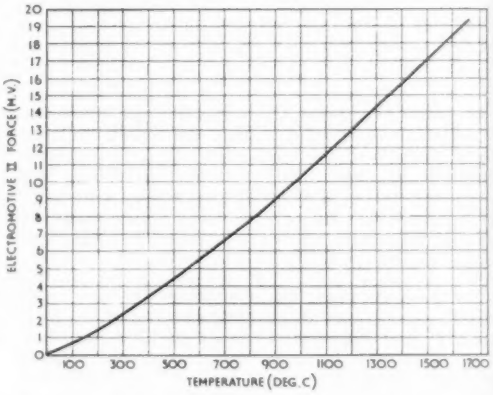


FIG. 3.—*The relationship between electromotive force and temperature is shown for platinum-platinum/13-per cent. rhodium alloy.*

Maintenance

In addition to the points already discussed, there are other precautions which must be observed if pyrometers are to be kept in good order. In this connection the following observations may be of assistance:

Remaking the Hot Junction: Depending on the temperature of service, the hot junction of the platinum-metal thermocouples should be re-made after a number of immersions. The frequency of renewal depends on the service, *e.g.*, in molten steel at 1,650 deg. C. the thermocouple should be used up to only 30 times; with lower-melting-point alloys up to 50 immersions may be employed. The thermocouple should not be used for longer periods, because at the highest temperatures rhodium volatilizes from the platinum-rhodium wire and is re-deposited onto the platinum, with the result that the emf. characteristics of the thermocouple are altered. To re-make the hot junction, the platinum-platinum/rhodium alloy wires are untwisted (a weld is not regarded as essential), and

a 2 to 3-in. length of the thermocouple wires are pulled through from a reel box which is attached at the other end of the thermocouple sheath. This amount of wire is cut off and returned to stores for credit with the platinum-metal supplier; a new hot junction is formed, and a fresh sheath is fitted. In making the hot junction it is good practice to leave about $\frac{1}{4}$ in. between the hot junction and the nearest insulating bead, thus lessening the risk of the sharp-edged beading cutting into the platinum-metal thermocouple elements, which would cause premature failure. In England, the diameter of the wire used for thermocouples is 0.020 in. The only effect using other diameters will be a slight variation in response rate. At 0.020 in., experience has shown that there is a minimum amount of platinum metal in service at one time, keeping losses through theft to a minimum; simultaneously a reasonable life is obtained at this size.

Firing: Before assembling a thermocouple, the refractory sheaths, thermocouple-insulating beads, and extension tubing should be fired[3], to eliminate all vestige of oily vapour left as a residue of the greases used in the manufacture of the sheath components. The platinum elements, after annealing, should not be touched by hand, as a grease residue might thus be left on the surface. As a result of firing, there will be no oily vapours to decompose when the thermocouple is heated. Such vapours, if present, would reduce refractories in the thermocouple sheathing, with resultant attack of the platinum.

Storage: When thermocouples are not in service, they should be stored in racks placed in convenient proximity to their service stations.

Resistivity: Whilst in a potentiometric circuit, unlike a circuit using a millvoltmeter, high resistance will not affect the reading ultimately indicated; it will however affect the rate of response. In order to reduce resistivity to a minimum, it is advisable to keep the indication within a reasonable distance, *e.g.*, 100 ft., of the thermocouple. Even more important is to ensure that the plugs and sockets of thermocouple connections are free from dirt and oxide.

To ensure that the indicator is working correctly, makers' instructions should be followed. Most modern instruments have a calibration device which supplies a fixed emf. to the instrument when the appropriate switch is operated, thus permitting checking of the instrument. Checking of the external circuit may be carried out periodically, using a portable potentiometer with a calibrated thermocouple; during this operation the hot junctions of the two thermocouples should be in intimate contact when immersed in the molten metal. Should there be a substantial discrepancy of reading, all members of the circuit should be examined, particular attention being paid to the conditions at junction boxes, and to ensuring that the platinum and platinum/rhodium elements are correctly connected to their matching extension cables.

Conclusion

Careful observance of the recommendations made in these notes should obviate any difficulty in measuring temperatures. Finally, it must again be emphasized that it is highly desirable to appoint one skilled man to be responsible for maintenance of all the temperature-measuring equipment.

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[3] F. K. Schofield and A. Grace, "Quick-immersion Thermocouple for measuring the Temperature of Liquid Steel, both before and after being tapped from the Furnace," Iron and Steel Inst. Special Rept. No. 25, 1939, 239-264.

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* Added by the Editor.

Metallurgical Abstract

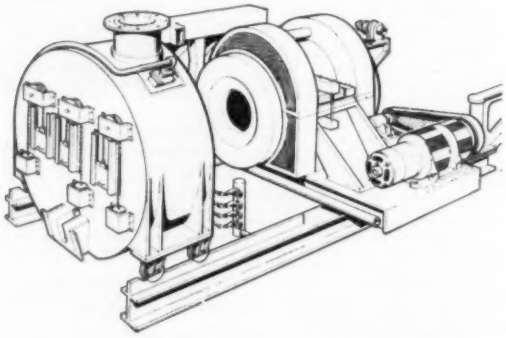
Stress-relieved Castings. E. W. P. SMITH. (Iron Age. 1959. Vol. 184; No. 23; pp. 116-117). Residual stresses are caused by differential solidifying and cooling of the metal. As the molten metal cools, the outer layers are usually the first to solidify and contract as the metal continues to cool, the already solidified metal opposes further contraction, this introducing residual stresses. Very sensitive gauges are used to measure the strain in castings. Wire strain gauges are cemented to the material upon which stress measurements are to be made. As the material is stressed, both it and the gauge compress or elongate, depending upon the type of stress.

Compression or elongation causes the gauge to change resistance in proportion to the strain. One technique of stress analysis is to cut away portions of the casting. Any residual stresses in the metal are released when the metal is cut away. The section that is left assumes a "free state"; it is no longer restricted by the surrounding metal. Strain-gauge measurements are made before and after cutting portions away. They reflect any change in dimensions in the remaining test section. This procedure can be carried out on both as-cast and stress relieved castings. Castings are cut at the mould parting line. Care must be taken not to generate too much heat when milling the metal. After each cutting step, strain-gauge readings are taken with a strain indicator.

Equipment and Supplies

Desulphurization

Most of the existing methods of metal desulphurization used in foundries are batch processes, which involve ladle treatment with calcium carbide or soda ash. Now, however, a continuous process of desulphurization has been developed in America by the Diamond Alkali Company, of Cleveland, and has been fully piloted at the Battelle Memorial Institute on a 5- to 10-ton per hour scale. In this country, Foundry & Metallurgical Equipment Company, Limited, of Netherby, Queens Road, Weybridge, Surrey, are manufacturing this equipment, which is known as the Efco-Diamond Reactor. The process is based upon the fact that in all molten metal/slag reactions, if the surfaces of contact can be increased, the reactions take place extremely rapidly and completely. This is effected by introducing the molten iron into a horizontal rotating drum—called the reactor—which is spinning at sufficiently high speed to centrifuge the contents. The drum is refractory lined, and the molten metal assumes the form of a relatively thin film over the refractory lining. Any addition to the drum of materials such as soda ash, caustic soda or lime, being of a considerably lower density, forms an "inside" film on the molten metal, and due to the centrifugal action is forced into contact with the liquid iron.



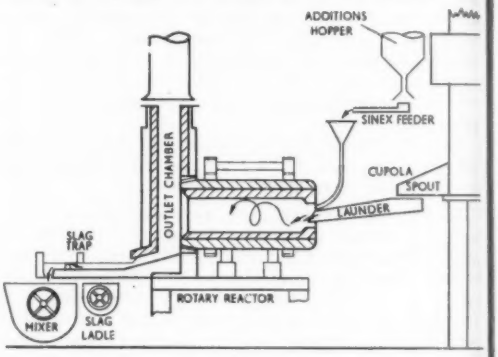


FIG. 1.—(*a*) *Perspective view of a typical Efco-Diamond rotary reactor, and* (*b*) *diagram showing the sequence of operations for desulphurization.*

Sequence of Operation

As shown in Fig. 1(*b*), the molten metal and the reacting materials are fed in at one end and flow through on the inner surface of the drum to the discharge end, where the metal and slag are sprayed out into a collector box or chamber. The flow through the reactor can be described as taking the form of a turbulent helix, and the total reaction time is only of the order of 10 to 15 sec. As the slag-making reactants do not come into contact with the lining of the rotating vessel, there is practically no lining wear and highly reactive materials, such as caustic soda, can be used for sulphur removal. At the top of the collecting chamber there is a hood or offtake, so that all fumes can be ducted out of the foundry. Slag and metal can be separated from the equipment by a slag dam on the molten-metal outlet. Due to the fact that the reaction time is so short, it is claimed that the temperature drop in the process is extremely small—of the order of 25 to 40 deg. C.—whilst the drum can be heated by gas or oil, if required. In fact, the reactor is, of course, preheated in this way before use. Also deriving from the short reaction-time is the fact that the size of the equipment is relatively small compared with the output. For instance, a 10-ton-per-hr. unit has a drum 2 ft. dia. by 4 ft. long.

Construction Details

Fig. 1 (*a*) is a perspective view of a typical unit. As will be seen, the equipment consists of a base with a driving motor and variable-speed gearing which drives the support rollers for the horizontal drum. The collecting chamber at the end is removable (on a roller track) for maintenance, and there is a water-cooled seal between the rotating drum and this collecting chamber. A launder feeds molten metal into the drum inlet, and a vibratory feeder controls the quantity of solid additive. Generally, 20 to 30 lb. of desulphurizing agent is added per ton of metal, depending upon the agent used. Some results reported as typical of the operation of one of these units are :

Cupola Metal S (per cent.)	*Same metal after Treatment* S (per cent.)
0.072	0.014
0.079	0.016
0.099	0.013

For foundrywork, standard-size units are now available with outputs between 5 and 10 tons per hour, and between 10 and 20 tons per hour. Still larger units, especially designed for refined-irons manufacture and treating of blast-furnace metal, are also available.

Payloader Tractor Shovel

Latest product of the Doncaster works of the International Harvester Company of Great Britain, Limited, is the Hough payloader. The first model, the Hough H-70 payloader, is a 105-h.p., four-wheel-drive tractor shovel, with a carrying capacity of 7,000 lb., which can be equipped with a wide range of buckets for specialized purposes. The tractor is equipped with torque converter and Paylomatic power-shift transmission providing three travel ranges, in both forward and reverse directions. The unit is an entirely new product, and will not embody any units used in current wheel or crawler tractor production.

Nodularizing Alloys: The alloys division of Union Carbide, Limited, 103 Mount Street, London, W.1, is now the sole agent for alloys VL55 and VL55M manufactured by Metallgesellschaft. These alloys are used as nodularizing materials in the production of spheroidal-graphite iron.

Foamed-plastic Patterns for making Art Castings?

Mr. Alfred M. Duca, a professional artist and research associate in the department of metallurgy at the Massachusetts Institute of Technology, has perfected a process that might possibly revolutionize the casting of art objects, because of its simplicity and cheapness. There is no "secret" to the new process, only the adaptation of a material that has been known for many years—foamed polystyrene. This is a lightweight, stiff, porous plastic that looks much like a block of snow. It is made with densities ranging from 1.8 to 6 lb. per cub. ft. A piece the size of a 6-ft. man, for example, might weigh about five lb.

Mr. Duca, a prominent Boston artist, experimented with polystyrene as a sculpture material 10 years ago, and it was then that his interest in it was first aroused. At an exhibition of his sculpture, last year, he met Professor Howard Taylor. As a result of their mutual interest in reviving art casting, Professor Taylor brought Mr. Duca to the MIT staff to do research in casting sculpture. With Professor Taylor's co-operation and support, Mr. Duca has received a $10,000 grant from the Rockefeller Foundation to study ways in which a revival of interest in casting can be brought about.

"Foam Vaporization"

The new process, called "foam vaporization," is claimed to be simpler to carry out than the lost-wax method. The statue to be made is first carved from a block of polystyrene, using simple tools such as knives and files, and the carving is then enclosed in a conventional sand mould, which has runners hardened by the CO_2 Process. When the metal is poured, the polystyrene vaporizes and a finished casting is produced. Professor Taylor states that there are many advantages to the foam-vaporization method: "This process provides an extremely versatile medium in which to work," he says. "When modelling is done in clay, mechanical supports are often needed to hold the model together because of its weight and lack of rigidity. There is much more structural freedom with polystyrene, since such supports are not needed. Statues can be carved and cast that would previously have been impossible. The process provides a faithful reproduction of the original shape—in fact, the original shape "turns into" the casting by being completely replaced by metal. It thus preserves the "organic vitality" of the work.

FIG. 1.—*Polystyrene model for a 30-in.-high "Pegasus," carved by Mr. Alfred Duca. The casting itself weighs 3¼ cwt. (plus base).*

Because of the costs involved, art casting of sculpture has at present nearly disappeared from the American scene. Sculptured pieces are sent to be cast in Europe, a procedure which is expensive and time-consuming. This foam-vaporization method is reported cheaper, and can be easily carried out with existing foundry facilities. The material itself is readily available, and is no more expensive than wood."

Mr. Duca says that there are several modifications he wants to make in the process: for example, a more tactile material is needed, so that the artist can model directly with his hands rather than with knives and shapers, and a wider range of surface textures is also desirable. Technical details of the process will be published in the near future. The most dramatic work that has been made with the process so far is a 400-lb. "Pegasus" (see Fig. 1). Other castings that have been produced by the new method include a number of minor pieces in ductile iron, the most important of which is a 200-lb. work titled "The Vertebrate." Soon to be cast is a 9-ft. "Crucifix," which Mr. Duca has spent two months in carving.

Mr. S. H. SHEPPARD, for 47 years chief buyer for George Fletcher & Company, Limited, ironfounders and engineers, of Litchurch Lane, Derby, retired on March 31. Seventy-year old Mr. Sheppard joined the company in 1910. On behalf of the company, and on behalf of the board of directors, Mr. C. W. Murray, chairman and managing director of the company, presented Mr. Sheppard with a pair of armchairs and an electric toaster. From his colleagues he received the gift of a wireless set.

Three members of the staff of Cochranes (Middlesbrough) Foundry, Limited, have been presented with gold watches in recognition of their long service. They are Mr. A. JEFFERSON, Mr. R. A. PEEL and Mr. G. E. L. SMITH, all of whom have completed 30 years' service with the company. Mr. N. C. Macdiarmid, managing director of the Stanton Ironworks Company, Limited, the parent company, made the presentations, and he also presented other long-service awards to employees.

*Craft Apprentices' Corner**

Melting Iron in the Cupola . . .

. . . with "Tubal Cain" on the Job!

Just t'other afternoon one o' my moulders came grumblin' to me about 'aving ter wait for iron to cast 'is job. Well now, that ain't nothin' afresh for Bert Briggs 'cos 'e's allus grumblin' about somethin', an' according to Bert it's allus somebody else's fault, never Bert's—fair painful to listen to 'im it is. Knowin' this, I guessed there was somethin' else on 'is mind, and sure enough there was. Seems like 'e knew we'd got a big cast on that day, an' trying to be a bit clever 'e'd closed is job early on, thinkin' 'e could get cast up an' out the shop a bit sharpish. Well it just didn't work out that way, an' as time goes by poor Bert gets to worryin' a bit about the steam "striking-back," an' that's what brought 'im up to me with 'is grumble.

It takes time . . .

"See here Bert," I says to him, "Y'know we've a big cast on, and y'know you'll get cast up in your turn. But there's sense and reason in all things, an' I ain't got no time for a bloke who's too clever for 'imself—if that job's a waster you'll stand to it! What you want is a cupola shaped like a beer-barrel, with a tap at the bottom so you can turn it on an' off just when you feel like it, but they don't make that kind o' cupola yet. It takes *time* to melt iron in our kind o' cupola, an' if you can show me 'ow to get six tons an hour out of a three-tons an hour cupola you've got yourself a job, mate, startin' right now at double your present wages!"

. . . to melt iron . . .

"Hold on a bit, gaffer," Bert says, "I didn't mean it that way at all—I ain't no cupolaman, don't know the first thing about it, in fact." Anway, after a bit more palaver in the same vein, 'e went off sheepish enough, an' I went round to the cupola to see 'ow things were shaping. An' then I got on to thinkin' about old grumble-guts, an' 'ow 'e'd get on if 'e 'ad to melt 'is own iron; an' not only Bertie boy but quite a lot of other moulders besides. They'd be in trouble sure enough. But not in half so much trouble as the poor old customer who was waitin' for 'is castings! Well now, if that's the case with the old hands, what about you young 'un's? Some of you, I know, have studied this subject at your technical classes, but have you studied the *cupola as a melting unit*, as opposed to *melting iron in the cupola*? I wonder! Right—now you are probably all familiar with the general design of a cupola as used in the jobbing foundry, but just to make quite sure here is a diagram of the cross-section of a typical one (see Fig. 1).

. . . in a cupola.

For actual working purposes the cupola is divided into four separate zones, each of which has its own part to play in the overall proceedings; in order to understand fully the working of the cupola it is essential to be familiar with these zones, and to know their purpose. The distance from the cupola bottom to the slag-notch is known as the Well, and is the part of the cupola which contains or "holds"

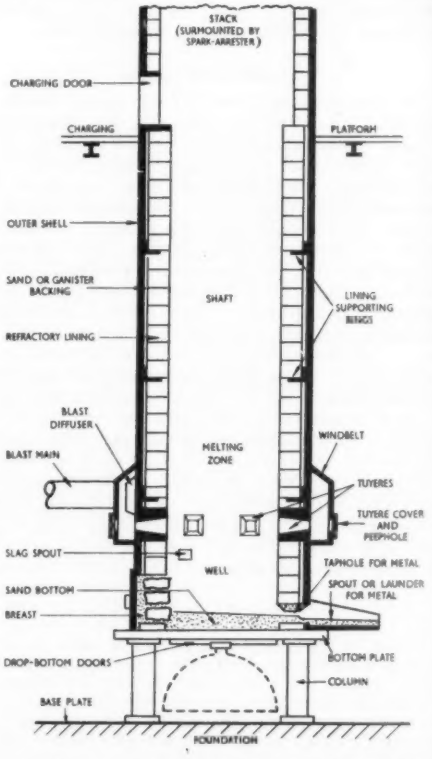


FIG 1.—*Cross-section view of a typical jobbing-foundry cupola, showing the four separate zones.*

* As is usual in this series, the popular jargon of the foundry floor has been retained in some parts of the article—apologies are made to trans'ators—Editor.

the molten metal prior to tapping-off. The Melting Zone reaches from a little above the row of tuyeres to some distance up the body of the cupola—according to the design and operating conditions this distance will vary with different cupolas, and may be anything between 20 and 60 in. (above the tuyeres). As a general rule, however, it is about 30 to 36 in. This is the zone of maximum temperature obtaining in the cupola, and it is in the upper region of this zone that the actual melting of the iron takes place. Hence, it will be readily understood that this is the most important part of the cupola, and the one on which all calculations are based. The distance from the top of the melting zone to the charging sill is known as the Shaft, and is the part of the cupola which holds the charges of iron, coke and limestone. It may sometimes be referred to as the pre-heating zone, because the charges of iron are here pre-heated by the upward passage of the hot waste gases. The part of the cupola above the charging door is called the Stack.

After a special charging routine, . . .

So far, so good—now let's consider the actual melting process. Melting is brought about by burning a suitable fuel (coke) in intimate contact with the solid iron, and the first step in the melting process is to provide a bed of incandescent coke as a source of heat. This coke bed will reach from the cupola bottom to a distance a little above the maximum height of the melting zone, and for the purpose of this article we will assume that the coke bed has previously been lighted and allowed to burn through completely. The first metal charge will now be placed on top of the coke bed, with a charge of coke and limestone on top of the metal charge. Metal, coke and limestone are now charged in alternate layers until the cupola is full to the charging sill. Expressed diagramatically, a cross-section thro' the cupola would look like Fig. 2.

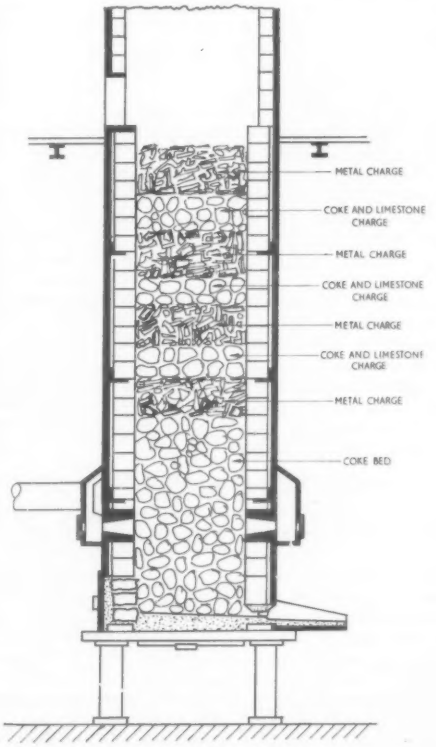


FIG. 2.—*Section through the cupola immediately after charging, and before commencing the "blow."*

. . . the blast is put on and . . .

Right—melting can now go forward. The blast is switched on and air enters the cupola thro' the tuyeres, causing the coke in the melting zone to burn with intense and rapid combustion. Some of the coke in the upper region of the melting zone is burned completely away, thus lowering the height of the coke bed a little and automatically bringing down the first metal charge right into the melting zone, where it melts and trickles down thro' the coke bed to collect in the well. Whilst the melting of this metal charge is going on, coke is still being burned off the bed, but melting this metal charge automatically brings down the next coke charge which settles on top of the coke bed. This coke charge thus replaces the coke which has been burned off the bed and restores the coke bed to its original height. Melting then proceeds by repeating the cycle of burning coke and melting metal continuously, at the same time adding further charges of coke and metal through the charging door. Although in theory the charges descend the shaft uniformly, in actual fact melting undoubtedly proceeds more rapidly in the centre, so that the falling charge layers assume a u-shape.

. . . molten metal collects in the well, . . .

Whilst melting is going forward, molten metal is continually collecting in the well, from whence it may be tapped-off as required. Just in case some of you are wondering what happens to the coke in the well when the molten iron reaches the well, the answer is simple—it (the coke) stays where it is and the molten iron lies in the voids between the individual cokes. Why do I mention this ? Simply because I have talked with quite a few foundrymen who thought that the coke bed lifted up to make way for the molten iron underneath it; just *how* they couldn't figure out!

. . . the melting process being continuous.

This then is an outline of how iron is actually melted in the cupola—what significant fact emerges from all this? Simply this, that the process of melting iron in the cupola is a continuous one, and one which will go forward at a given rate for as long as the cupola is operating, barring any unforeseen hold-ups, that is. It is for this reason that the melting rate of a cupola is assessed as so many hundredweights or tons per hour, according to the internal diameter at the melting zone.

"Blown"

Practical Hints for the Moulder on how to avoid Castings being Scrapped because of Entrapped Gas

By "Jacques"

Inquests on rejected castings usually indicate the category of the defect, and give a pointer to ways and means for removing the cause. Inspectors' classified reports and verdicts are usually phrased in foundry nomenclature, which may vary with the district. However, there are three definitions that are universal, whatever local descriptions for other scrap may be; these are: "blown," "scabbed," and the moulders' occasional "buck-passing-get-out," "dirty iron" (not forgetting the foundryman's verbal, but unrecorded, description of "cause not known," which if set down here would invite the Editor's blue pencil).

In completely mechanized moulding production, where every phase and facet is carefully watched and controlled, and first-class plated patterns and matching coreboxes are mated to a "pedigree" standard, the three types of wasters do not get severely out of hand, except perhaps in the case of an occasional "bout" of "dirty iron" (which could, of course, be "dirty pouring"). If this is of epidemic proportions it can usually be cleared up by shifting a "slack" ladle-handler, or by strategically placing filter inserts into the runner system, as shown in Fig. 1(*a*). A broken-off runner bar is shown at (*b*), and arrows indicate the metal flow. Inserts may be round, square or rectangular, and two or three sizes and capacities will usually cater very effectively for most running systems. This article is mainly concerned with "blown" defects in loose-pattern and semi-skilled plate-moulded production. The tell-tale evidence of these is not always looked for or expected, and is quite often so momentary in effect as to pass unnoticed on the top of a feeder-head or the runner-box of a "just-poured" mould.

There are some moulding shops where the sand for hand- or mechanically-rammed moulds is heaped and prepared on individual floors, with a semi-standard facing sand drawn from a bulk supply. Sometimes this is re-dampened or "doctored" to the user's experience or imagination, as to whether a "good-looking" knife edge mould rammed up in semi-mud is preferable to a sharpish "over-dry" sand-mould mended up with the water brush. Both of these types of moulds are unsuitable for quality or machined-up castings, and usually, after a "caning" with the inspector's case-hardened pick hammer, or maybe a second cut in the machine shop, "aero-cellular" material is exposed.

Free Core-vent Exits to Atmosphere

A "blown-off-the-mould" verdict is usually accepted without challenge if a job has no internal dry-sand cores. Moulding sands generally are rarely completely inert under intense heat, and usually generate (more or less) rapidly expanding gas during the pour, which will readily ignite and burn freely in atmosphere. A mould rammed up in over-wet sand and poured "green" will provoke metal agitation, which is often indicated within a few seconds by the internal steam pressure swelling the molten metal back into the full feeder-head or runner-box. This swell may be accomplished by short spurts of flame.

If a top-face, open core-vent hole is handy to the runner box or riser, as at (*c*), the overflow metal will plug the vent and most likely cause a violent internal gas disturbance and expansion, which will force its way out with the steam up and through the metal with a volcanic-like vomit, *via* the riser or runner. With both "green" and dried moulds, free core-vent exits to atmosphere are most essential. "Blown-off-the-core" wasters are almost invariably caused by restricted or plugged core-vents and outlets. A simple and ancient remedy is to cut a "ricket" or groove in the bottom half of the mould leading from the core-vent outlet to the moulding-box edge (see Fig. 1(*d*)). Even with close-fitting joints, the expelled gas will then escape freely.

With moulds where the core-prints and cores are of true shape and close-fitting, mould joint-rickets are reasonably safe against metal "flash" entry. But where moulds are poured with "searching" high-temperature metal, and there are slack-fitting or misshapen cores or prints, joint rickets invite a run-out during the pour. This is sometimes stopped by a frantic pile-up of floor sand rammed round the running-out area, thereby plugging the core-vent outlet with precisely the same effect as described above. Sometimes, on multi-cored and heavier castings, a running-out mould has to be abandoned if the cascade becomes too severe or the pouring ladle runs empty.

Avoiding Metal Penetration of Core-vents

An easily-applied and positive way to prevent the "blown" risks mentioned is to give the moulder an ample supply of various short pieces and diameters of tube—scrap electrical conduit and elbows suffice admirably. These are rammed-up in place to the core-vents, as at (*e*), and when in use quickly "high-light" the importance of free-burning core-vents. Tradition and "once-upon-a-time" training always stressed, and should still do so, the necessity of sealing core-vents against metal penetration. Tubes rammed up in place are no more "trouble" than the old timer's down-stick used for the same purpose, and then withdrawn to leave a top-face-level hole, as at (*f*). If

the pouring ladle slip-tips an inch, or there is a hesitating lift-out to the runner stopper, the overflow metal may immediately plug the hole—a piece of tube rammed-up in place as a chimney is an adequate preventive measure (see Fig. 1 (*g*)).

Many of the larger-type moulding-boxes have side holes, spaced at intervals, which are often used for bolting side grates and other moulding routine. Any of these holes may be used in the manner shown at (*h*), in which rope is employed to "side-step" an out-of-line core-vent outlet into the nearest one. The rammed-up level is then as shown, and the rope pulled out after closing the mould. This provides an effective seal against metal, and also a level mould-joint which is proof against a run-out. On large sets, where side-face core-prints mate-up to each other, a short piece of tube (*j*), rammed up in place will "freeze" any small penetration of metal at the core-print joints (*k*). Such metal will sometimes "scour" a way into unlevel faces, and into the cores' internal cinder layers and pockets, thus causing "blowing," and sometimes a "wasps'-nest" clump of cinders and iron inside the casting which is impossible to get at to break up and remove.

A useful time-saving method, which can be made standard practice for all pattern core-prints, is the cut-in half-round or V-groove shown at (*l*). This groove is reproduced in the mould, and will seal slack or slightly misshapen cores against metal. Joint rickets can then be used on otherwise undisturbed mould joints with every assurance of success. On multi-cored moulds such as diesels, machine-tools and other large castings, planned tubes rammed-up in place will indicate precisely, during the pour, any "free," "restricted," "dead" or "hard-pressed" core-vent exits. Individual cores and connected runs can also be identified and their efficiency noted. Other locations for vent-tube application will be indicated automatically wherever a "blown-off-the-core" verdict in the scrap report recurs too often.

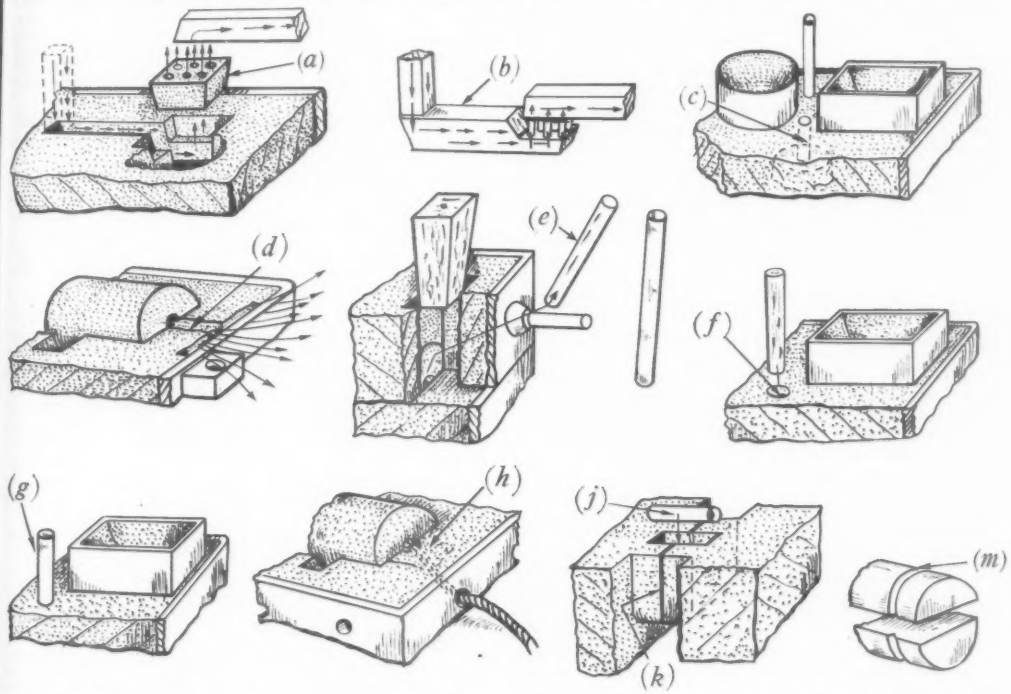


FIG. 1.—*Diagrams showing various techniques which may be used by moulders to avoid "blown" castings.*

NEEPSEND STEEL & TOOL CORPORATION, LIMITED—Mr. C. Cavill and Mr. G. W. Hollingsworth have joined the board.

BRITISH PISTON RING COMPANY, LIMITED—Mr. P. Sprawson, secretary and chief accountant for the past eight years, has been appointed to the board.

TWEEDALES & SMALLEY, LIMITED—Mr. John Phillips, who resigned as managing director in 1958 but remained a director, has retired from the board.

COZENS & SUTCLIFFE (HOLDINGS), LIMITED—Mr. Thomas R. Parsons, Mr. Samuel H. Forbes, and Mr. Hedley E. Mutton have been appointed to the board.

Company News

Prospects for Delta Metal Company

An encouraging opening to the present year is reported by Mr. W. E. Ogden, chairman of the Delta Metal Company, Limited, of London, S.E.10. He says that trade is good and although the agreed reduction in working hours would tend to increase production costs, it was hoped this would be counterbalanced by greater concentration of effort by employees.

The directors expect that when the new plant is working towards the end of 1961, the company will be able to meet the increasing demands of road and rail transport, marine, chemical, building, aircraft, and domestic utensil industries. Mr. Ogden points out that the immediate gain may not be so apparent, although the long-term results of the venture are likely to be of great benefit. Group net profits rose from £1,071,842 to £1,466,213 in 1959 and the distribution is raised by the equivalent of 2 per cent. to 17½ per cent., as already stated.

G. & J. WEIR, LIMITED, engineers and founders, etc., of Glasgow—Issued share capital of the County Water Softener Company, Limited, of Purley (Surrey), has been acquired by the company.

DANIEL ADAMSON & COMPANY, LIMITED, manufacturers of boilers, turbines, etc., of Dukinfield (Ches)—Net profit fell from £102,692 to £72,004, after tax of £26,499 (£100,621). The dividend is maintained at 15 per cent. with a final of 12 per cent.

ENFIELD ROLLING MILLS, LIMITED—Dividend of 15 per cent. is maintained with a 12½ per cent. final dividend for 1959 on capital increased by the acquisition of Enfield Cables, Limited. Net profit was £892,432 (£737,725), after tax of £793,000 (£810,000).

RICHARD CRITTALL & COMPANY, LIMITED, heating, ventilating, and air-conditioning engineers, of London, W.1—The dividend is raised by 5 per cent. to 22½ per cent. for 1959. Group profit was £252,154 (£222,829), and after tax of £111,099 (£82,422, when there was relief for prior losses), the net balance is £141,055 (£140,407).

WILLIAM DENNY & BROS., LIMITED, shipbuilders and engineers, etc., of Dumbarton—In addition to raising the dividend to 15 (12½) per cent. for 1959, a further special dividend of 5 per cent. is to be paid on account of the financial outcome of certain contracts completed in earlier years. The net profit is £112,784 (£76,646), after tax of £145,128 (£69,608).

HERBERT MORRIS, LIMITED, makers of cranes, mechanical-handling equipment, etc., of Loughborough—An interim of 4 per cent. on the ordinary share capital as increased by a one-for-one scrip issue is announced. The directors state that the slower recovery in the capital goods industries during the latter part of 1959 is likely to affect profits for the current year.

PARKINSON COWAN, LIMITED, makers of metering fluids, electrical control and home equipment, etc., of London, S.W.1—The meter and instrument divisions had a poor year though business improved towards the end and is now running at a very satisfactory level. As stated, group net profits rose from £199,502 to £281,184 and the dividend is effectively increased by 5 per cent. to 17½ per cent.

ALGOMA STEEL CORPORATION, LIMITED—Net sales of $162,696,199 were a third higher than in 1958 and 14 per cent. higher than the previous record year of 1957. Net profit rose from $2.04 a share in 1958 to $3.05 a share on 5,766,180 shares outstanding at the end of 1959, and amounted to 10.7 cents per dollar of income compared with 9.5 cents in 1958. The dividend remains at $1.00 a share.

FRY'S (LONDON), LIMITED, tool manufacturers, etc., of London, S.W.1—The company's turnover has been substantially increased during the first six months of its present financial year, compared with the same period last year. A rights issue is proposed of 480,000 ordinary shares of 2s. each at 4s. 6d. a share, in the proportion of three-for-five. The directors feel confident that the same rate of interest can be maintained on the increased capital.

BAKER PERKINS, LIMITED, manufacturing engineers, etc., of Peterborough—The dividend at 2s. a £1 share for 1959 is maintained with a final of 1s. 6d. a share, and a one-for-four scrip issue is also proposed. The directors expect to maintain the dividend rate on the increased capital. Net profit is £417,924 (£415,722) after tax of £292,989 (£463,590). The backlog of orders is greater than at this time last year and the directors hope that the 1960 results will be better than those for 1959.

Integration of Dowty Group Companies

Gloucester manufacturers of accessory driving equipment, Rotol, Limited, which, with its subsidiary, British Messier, Limited, became members of the Dowty Group, Limited, on January 1, 1959, have now been completely integrated with Dowty Equipment, Limited. The new combined business is trading under the name Dowty Rotol, Limited, and will undertake the fulfilment of all outstanding contracts of the three businesses.

The board of Dowty Rotol has been constituted as follows:—Chairman, Sir George Dowty; joint managing directors, Mr. C. J. Luby and Mr. E. J. Nicholl; Mr. L. T. P. Banbury and Mr. R. F. Hunt; works director, Mr. A. E. Atkins; experimental works director, Mr. H. S. Butt; technical director, Mr. L. G. Fairhurst; commercial director, Mr. F. J. A. Mangeot, and financial director, Mr. G. F. M. Rufford.

Communications for any of the companies should now be addressed to Dowty Rotol, Limited, at Cheltenham Road, Gloucester ('phone: Gloucester 24431).

Australian Subsidiary for Armstrong Whitworth

Following the opening of Armstrong Whitworth (Australia) Pty., Limited, Mr. R. H. Philip, director and secretary to Armstrong Whitworth (Metal Industries), Limited, flew to Australia on April 7 to complete administrative arrangements.

The company, which is a new subsidiary of Armstrong Whitworth (Metal Industries), manufactures Kue-Ken crushers, A.W. Overstrom screens, Closeloy rolls, oilfield equipment, and is also a large producer of iron and steel castings and refined pig-iron.

Metal Closures' Dividend

The dividend of Metal Closures, Limited, of West Bromwich (Staffs), is raised from the equivalent of 21¼ per cent. to 24 per cent. for 1959, with a final of 13 per cent. A final of 11 per cent. was forecast at the time of the merger with John Dale, Limited.

Before tax, group profit of £831,685 compares with the forecast at the merger of not less than £725,000. The profit, after tax of £373,278 (£209,345), rose from £204,043 to £458,407.

Polish Foundry Abstracts

The latest issues of the Polish foundry journal, *Przeglad Odlewnictwa,* to reach the FOUNDRY TRADE JOURNAL office contain a number of lengthy articles from which abstracts are reproduced as follow:

Preheating of Patternplates to reduce the Sticking of Moulding Sand, by K. Hess and J. Horoszko

In this article, preheating of patternplates as an alternative to coating the pattern with a parting material to reduce the sticking of moulding sand is discussed. After first classifying factors influencing the sand quality during stripping of the pattern, two of them are dealt with more fully. These are the adhesive factor and the friction factor and the relationship of these with other factors (especially with regard to temperature) are studied. The method used for investigating sand adhesion and friction in contact with a pattern is described and several solutions are given to the problem which involve preheating of the patternplates.

Method of Heating Cupola Blast, by R. Wozniacki

The author discusses the advantages of heating cupola blast and includes in the article a classification of cupolas with various types of blast heating. Types of metal recuperators—with special consideration of radiation recuperators—are presented and the problem of blast heating is discussed in relation to conditions prevalent in Poland. The scope of co-operation of the Foundry Research Institute in Krakow with the *Centre Technique* in France is discussed. Finally, the design of equipment in the experimental foundry of the Foundry Research Institute is described and the preliminary results and evaluation of its work are given.

New System of Mechanization of Cupola Charging, by S. Komorowski

A new system of mechanization in the preparation and loading of charges into cupolas, developed by the Constructional Engineering Company, Limited, has been supplied to the Hill Top Foundry Company, Limited, at Wednesbury, near Birmingham, and is described in the article referred to. The basis of this system is a special make-up crane used for the preparation of metallic charges. This crane is of conventional overhead-gantry type having a structure suspended from it, in the base of which is carried a weighing machine with a crane operator's cabin immediately behind and slightly above the weigh-hopper. A variable-power magnet is used and as the crane moves between two rows of stockbins containing pig-iron, scrap, etc.; with this the operator can make up metal charges very accurately. Coke and limestone are prepared separately through an automatic weighing machine, and a fully automatic swivelling charging crane is controlled by the driver of the make-up crane. The whole system is designed to allow one man (the driver of the make-up crane) to carry out all charging functions unaided. The system, it is reported, allows incoming bulk materials to be off-loaded and transferred to storage hoppers without interference with cupola charging-operations, being especially suited to mass-production foundries.

MBC Cupola and its Application, by M. M. Foulon

This article describes the MBC cupola not solely from the point of view of its use as a melting unit, but also as equipment having the capacity of controlling the course of a metallurgical process. Details are included of the furnace design and advantages of the particular unit are put forward.

Positive Blowers for Cupolas, by M. Gregoraszczuk and L. Zurawski

The authors discuss the principles of design and operation of blowers with the Rootes and Jaeger type of rotary-pistons. Formulas for calculating the actual output of the blowers and the power requirements are also included in the article. Features which will most interest foundry users of the blowers are included and a comparison of positive blowers with centrifugal types (mainly taking into consideration their application to cupolas) is made.

Polarographic Determination of Magnesium in Spheroidal-graphite Cast Iron, by J. Marcinkowska

The author's method of determining magnesium in s.-g. iron is based on dissolving the sample being tested and subsequent electrolysis of the solution, using a mercury cathode. In the electrolized solution having a pH value of 10, magnesium is precipitated by a solution of 8-hydroxyquinoline, and the excess amount of the latter remaining in the solution is determined polarographically. A comparative method of analysis has been applied, so as to provide a calibration curve for the interpretation of results, *i.e.*, a curve of relationship between the magnesium concentration in the polarographic solution and the wave height of 8-hydroxyquinoline. The error in determining magnesium in the sample by the method described is reported as from 3 to 5 per cent.

(The English titles of two other articles in the same issues are: "Casting of Steel Support-pedestals for Rolls, having an As-cast Weight of 10½ tons, using Feeder Heads with Exothermic Sleeves" and "Manufacture of Spheroidal-graphite Cast Iron in a Cupola Forehearth.)

Iron-ore Imports

Imports of iron ore and concentrates (except chrome iron ore and roasted iron pyrites) in February, and the totals for the first two months of this year and last, are shown in the table below.

From	Month ended Feb. 29.	Two months ended February 29.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Sierra Leone	77,520	113,340	143,210
Canada	99,120	102,040	223,405
Other Commonwealth countries and Eire	1,775	3,252	5,225
Sweden	368,158	446,804	740,061
Norway	18,091	79,572	58,305
France	51,956	62,013	93,143
Portugal	24,141	27,741	64,658
Spain	87,088	87,497	129,612
Algeria	144,228	298,289	324,833
French West Africa	—	44,698	—
Tunisia	71,552	121,183	121,247
Morocco (excluding Tangier) ..	68,267	92,162	138,242
Liberia	13,920	71,110	75,220
Venezuela	142,027	235,743	302,221
Brazil	68,178	91,460	109,533
Other foreign countries	57,382	17,995	117,581
TOTAL	1,293,403	1,894,899	2,646,496

ANOTHER PIPELINE under the River Tees to link the Billingham factory of Imperial Chemical Industries, Limited, with the Teesport works of the British Oxygen Company, Limited, is due for completion. It will enable oxygen to be supplied under pressure for the manufacture of ammonia by the oil gasification process.

Training Foundry Technicians

It was alleged at a conference of the Council of Ironfoundry Associations last year that there was a lack of short courses for training foundry technicians, and to ascertain the true position the Association undertook a survey of technical colleges teaching foundry subjects. The aim was to find out how many colleges were holding short special courses which would help in raising the technical standard in industry, in spreading more widely the best practices, and encouraging the application of research.

The courses arranged by the American Foundrymen's Society could be quoted as a good example of the type of instruction desirable: these cover such subjects as cupola melting of iron; gating and feeding of castings; shell moulds and cores; production of ductile iron; foundry refractories; foundry plant layout; sand testing and casting design and stress analysis. In Britain, probably the best known courses organized on a national basis are those held at the British Cast Iron Research Association; the National Foundry College, and the series of lectures given at Birmingham University, it is stated in the CFA *Bulletin*.

Of the 66 colleges approached by the Association, 61 replied, and from the information thus received the CFA reports that it would appear that few colleges have made provision for the required standard. However, some are planning to hold special courses during the coming year and subjects covered will range from pressure-cast pattern equipment to metallurgy for laymen. The following list shows the short technical courses held in 1959 or in progress at present.

University of Birmingham, graduate course in foundry science and engineering (8-10 lectures per week).
National Foundry College, an introduction to work-study in the foundry.
British Cast Iron Research Association, Birmingham, sand control.
Borough Polytechnic, London, foundry sands (six evenings).
Bolton Technical College, a course of six lectures—cupola practice, work-study, pressure-cast pattern-equipment, light alloys, foundry technology—training and practice, brains trust.
Bristol College of Technology, "The Running and Feeding of Castings" (two days).
The Technical College, Coatbridge, Lanark, two courses—"Metallurgy for Laymen—Foundry Work" (ferrous and non-ferrous); "Foundry Projects (Methods)" (20 evenings).
Clowne Technical College, Derbyshire, special course for foundry foremen and technicians on modern foundry practice (eight evenings).
Coventry Technical College, "The Running and Feeding of Castings" (two days, full time).
North Lindsey Technical College, course of four evening lectures on modern foundry practice.
St. Helens Technical College, course of eight evening lectures on melting control, covering melting furnaces, charging and metal analysis; course of eight lectures on sand control with practical work in the sand laboratory.
St. Helens Technical College, course on sand control (as above).
Southampton Technical College, a three-week full-time course on practical foundry work (students sitting for Diploma of Technology award).

Training the Potential Executive

The National Foundry College (Wolverhampton) has taken stand No. 65 at the Production Exhibition which is to be held at Olympia from April 25 to 30. A comprehensive arrangement of photographs will show in some detail the scope and aims of the College Diploma Course and details of the new three-year Sandwich Course will be available. Members of the College staff will be present throughout the week to answer enquiries.

Dr. ROBERT WESTWATER, manager of the technical service department of the Nobel Division of Imperial Chemical Industries, Limited, has been elected a Fellow of the Royal Society of Edinburgh.

Law Cases

Trainee Crushed

Injuries received by a young engineer-trainee in a works accident were so extensive that it was a wonder he was alive, Mr. Justice Davies was told at Stafford Assizes. The trainee, Mr. Brian James Gardner (19), received £6,500 in settlement of an action for damages against his employers, William Boulton, Limited, engineers and ironfounders, of Burslem.

Mr. E. Ryder Richardson, QC, said that Mr. Gardner was crushed by an object weighing about a ton when part of a lifting apparatus broke. He had been left with a paralyzed and almost useless left lower leg. Other injuries included a broken spine, and it was thought he might have increasing incapacity in his back as he grew older.

Counsel said that the employers had expressed their intention to keep Mr. Gardner in work. The company had given him clerical work, and was helping him to improve his position.

Thumb Injury Claim Fails

A machine setter who lost the tip of his left thumb when it was caught in a machine at work, admitted at Newcastle-under-Lyme (Staffs) County Court that the accident was his own fault. The plaintiff, Mr. Stanley Cartlidge (39), failed in his claim for damages against his employers, the British Thomson-Houston Company, Limited.

It was stated that the fencing around the machine was removed for a minor repair. Mr. Cartlidge had his hand in the works and accidentally restarted the machine. The plaintiff denied that he was grossly careless, but agreed that the accident was his own fault. When he started to make the repair his attention was distracted by a workmate speaking to him.

Judge H. A. Tucker found that defendants had not been guilty of a breach of statutory regulations regarding the fencing of the machine on which Mr. Cartlidge was working.

Scrap Pans too near Work?

A moulder who was injured in an accident at the Tinsley foundry of Hadfields, Limited, of Sheffield, was awarded £350 damages and costs at Sheffield County Court. The plaintiff, Mr. Samuel Holmes (40), claimed £400 damages for a knee injury which kept him off work for 19 weeks.

He said that a hook he was taking off a moulding box came away suddenly and he fell backwards. To avoid falling into scrap metal pans, he moved right and twisted his knee. Mr. Holmes said he had complained before about the danger of the scrap pans being so near his place of work, but nothing had been done.

The company denied Mr. Holmes's allegations of negligence and breach of statutory duty and maintained that he was to blame for the accident. For the defence, Mr. A. F. Bates submitted there was insufficient evidence to say the accident was due to the negligence of the defendants.

After a long illness, Mr. MATTHEW HENDERSON CLARK has died at the age of 63. He founded the Thornaby firm of Henderson Clark, Limited, in 1927 and was the company's managing director. Mr. Clark became president of the North-Eastern Association of Scrap Metal Merchants, had served twice as president of the National Federation of Scrap Iron, Steel, and Metal Merchants, and for many years represented the north-east on the national management committee.

British Standards Institution

The British Standards Institution, through its solid-fuel industry standards committee, has recently considered informal inquiries which had been received about the possibility of a British Standard being prepared to cover foundry coke. Standardization work already deals with domestic coke and boiler coke. It was agreed that the subject should be remitted to the joint cupola coke quality committee, and the British Coking Industry Association for the purpose of exchanging views on all matters concerned with the quality of foundry coke. The joint committee is to hold a meeting next month.

A revision of BS 1017, Part II, 1960, "Sampling of Coke", has been published. This describes the methods of sampling and sample preparation, and also deals with the collection and use of statistical data on sampling. The Standard is not likely to be of much practical interest to the majority of iron foundries.

Revision of BS 1452 *and BS* 2789

The *Bulletin* of the BSI reports that in the revision of BS 1452, "Grey Iron Castings", it is proposed to introduce a new commercial grade C 10, which will not call for any mechanical tests. It is also reported that BS 2789, "Iron Castings with Spheroidal or Nodular Graphite", is being revised, and that six types of s.-g. iron are proposed, these types to be related to structure and mechanical strength.

Bid for World Crane Markets

A plan to combat the aggressive bid of continental crane manufacturers for world markets is announced by Steel & Company, Limited, of Sunderland, the parent of a group of three companies which amalgamated just over a year ago.

The three companies are Steels Engineering Products, Limited, Sunderland; R. H. Neal & Company, Limited, Grantham; and F. Taylor & Sons (Manchester), Limited, Salford. Hitherto, the three companies have had separate overseas marketing organizations, but from this month they will combine forces for selling abroad.

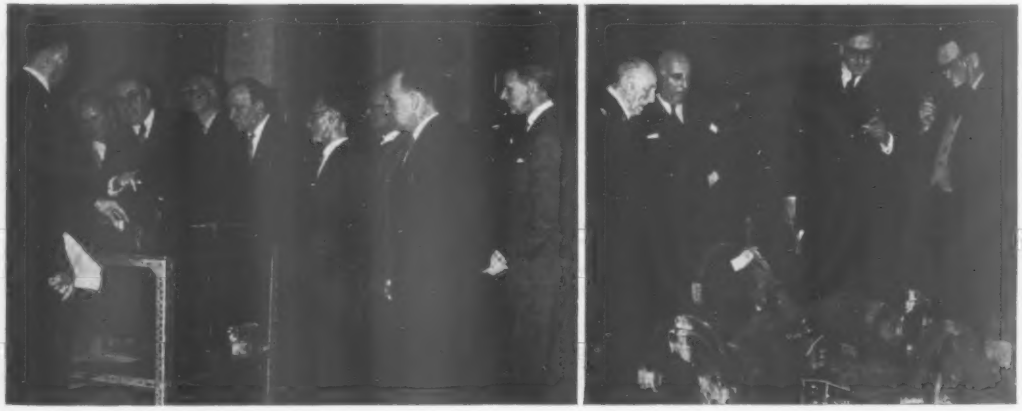
For this purpose, a separate marketing company has been created for each of three world zones. The British Crane Company, Limited, with headquarters in London, will organize marketing throughout the sterling area, four of the Outer Seven countries, Africa, and Asia. The International Crane & Excavator Corporation, of New York, will promote sales throughout the whole of the western hemisphere and other dollar areas, and a European sales company with headquarters in Switzerland will organize marketing in all Common Market countries, Austria, and Switzerland.

Mr. James Steel, chairman of the Steel group of companies, commented: "It is confidently expected that the new marketing arrangements will be more effective and more economical than existing arrangements and I expect the total volume of export orders to increase in consequence."

Trade Unions visit BSCRA

A group of 17 members of the: Amalgamated Moulders and Kindred Industries Trade Union; Amalgamated Union of Foundry Workers; Iron, Steel and Metal Dressers and Kindred Trades Society, and the United Patternmakers Association, were given details of the research activities of the British Steel Castings Research Association when they toured the laboratories and foundry on March 30 (see Fig. 1). The group, which included Mr. J. Gardner (formerly secretary of the AUFW) and Mr. J. H. Wigglesworth, O.B.E. (formerly secretary of the IS & MD & KTS), was welcomed by Dr. R. Hunter, chairman of the BSCRA Council, and introduced to some of the more interesting technical demonstrations by the Association's director, Dr. A. H. Sully. A vote of thanks was proposed on behalf of the visitors by Mr. F. Hollingsworth (secretary, AUFW), who was seconded by Mr. E. Tullock (secretary, IS & MD & KTS).

FIG. 1.—*Groups of visitors at the Trade Unions' visit to BSCRA: (left) first on right, Mr. James Jackson (of Jackson Elphick & Company, Limited, and member of the Council of BSCRA); second from right, Mr. E. Tullock (secretary, Steel Metal Dressers and Kindred Trades), and third from left Mr. J. Morvat (Wm. Beardmore & Company, Limited, and member of BSCRA Council); (right) from left to right, Mr. J. H. Wigglesworth, O.B.E. (late secretary IS & MD & KTS); Dr. R. Hunter (chairman, BSCRA Council); Dr. A. H. Sully (director, BSCRA), and Mr. J. Gardner (ex secretary of AUFW).*



Notes from the Branches

Sheffield

"Not so long ago it could be said that for every ton of castings produced, about 100 tons of material had to be moved—usually manhandled—between stockyard and fettling shops; the total distance moved by the operators would be close on seven miles. No doubt over the whole of the foundry industry great improvements have taken place in the last few years, yet in any industry where large amounts of materials have to be moved there is always scope for improvements both by revising old methods and by introducing regularly the fruits of technology." This was stated by Mr. L. Landon Goodman (industrial specialist of the Electrical Development Association), when speaking on "Materials Handling and Automation in the Foundry" to a meeting of the Sheffield branch of the Institute of British Foundrymen on April 4.

The lecturer went on to say that materials handling was "a necessary evil" and a first endeavour should be to eliminate the handling whenever possible. One way was by adopting suitable plant layout. In a foundry several materials flowed in a circle, *e.g.*, moulding sand and moulding boxes. This suggested that the knock-out section could well be alongside or close to the moulding department. In this way the lengths of conveyors, etc., might be considerably reduced. Again it was desirable that raw-material storage should be within the plant proper in a roofed-over yard or actually within the building so that the costs of double transfers were eliminated and the raw materials were adjacent to the melting operation. Thus an ideal scheme should be finalized and the practical arrangements brought as close as possible to that idea, bearing in mind practicalities and costs. Similarly, the planning of a fully automatic foundry was not a waste of time. The full plan might be (and no doubt would be) economically impracticable at present, but various facets might be found to be immediately applicable to the existing or a modified method of working.

Cranes were among the older types of handling equipment, familiar to all. There was thus a tendency for the latest developments to be overlooked and the more traditional forms to be used when a modern version would be more efficient. Gantry cranes were among the first choice where loads had to be moved about in a fixed area, though for some applications, as in warehousing and raw-material storage, fork-lift trucks had proved successful competitors in the last decade. A new type of crane had been developed for some of the applications to handle unit loads such as pallets. Beneath and fixed to the gantry crab was a mast on which was mounted a fork-lift unit that could rotate and move up and down. This crane was virtually an inverted fork truck. While it had not the flexibility of the truck it did not require the same gangway space or good floor on which to operate.

Other Improvements

Mr. Landon Goodman went on to say that great improvements had been made in contactor gear for steelworks cranes, giving more accurate control and hence speedier working. Ward-Leonard equipment was now being used on cranes to reduce the amount of, or eliminate altogether, contactor gear with its associated maintenance problems. Considerable progress had also been made in doing away with open, bare conductors supplying cranes and in safeguarding bare cross-conductors on cranes. Another safety measure that had recently been introduced was a crane-approach system which employed high-frequency sonic equipment. The dangers of collisions between cranes and over-running end-stops were eliminated, and complete protection could be given to maintenance men working on a disabled crane or crane track.

Automation, Mr. Landon Goodman said, could often be introduced in a number of stages, with the savings of stage one financing stage two and so on, and he took as an example the method of introducing additives to core sand. The traditional method of introducing them was by shovel or bucket from a sack or barrel. The first development would be bulk storage and manual feeding into the process. The next development would be bulk storage and manual control into a weigh hopper, then automatic control from push button, finally punched-card control and fully automatic process. Sometimes it was better to reach the stage of fully automatic control by steps over a period of time—and that not only from the practical viewpoint, for fully automatic plant presented a number of technical and commercial problems also.

Finally, Mr. Landon Goodman said that companies both large and small had found that production research and development paid off and also that many of these companies were leaders in the applications of electronics and automation. In these days of rapid technological progress, no organization, however small, could afford to rely entirely on its equipment suppliers for improvements and developments. A beginning had been made in many companies with work-study departments and often these departments had grown in technological competence. One of their most useful functions had been in releasing staff from day-to-day duties, and thus giving them "thinking time." Most-progressive firms had ensured that these departments were responsible to a director or senior manager. It had been surprising, too, what economies these departments had been able to make when new plant was ordered.

ISI Translations

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4, Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

1496 VELOCITY OF SOUND AS A CHARACTERISTIC VALUE FOR THE QUALITY OF CAST IRON. (From German). Ziegler, R., and Gerstner, R. 24th International Foundry Congress, 1957, (6), pp. 133-157. (£4 15s.). Ultrasonic radiation is used and the approximate relationship to modulus of elasticity related to amount of graphite, degree of saturation, tensile stress, disintegration of texture and amount of spherolites in spheroidal iron. Abstract *JISI*, 1963, Apr., p. 423.

1627 PRECIPITATION PROCESSES IN AUSTENITIC CHROME-NICKEL STEELS AND THEIR EFFECTS ON SUSCEPTIBILITY TO INTERGRANULAR CORROSION. (With discussion). Wiester, H.J. *et al. Arch. Eisenhüt.*, 1959, May, pp. 299-309. (£10).

1638 NEW METHOD OF PRODUCING MANUFACTURED ARTICLES DIRECTLY FROM A MELT. Stepanov, A. V. *Vestnik Mashin.*, 1959, (11) pp. 47-49. (£3 5s.).

Translations in course of preparation include:—

1652 ELECTRONIC CRANE WEIGHING-SCALES FOR USE IN IRON AND STEEL WORKS. Knüppel, H., and G. Wiethoff. *Stahl u. Eisen*, 1960, Feb. 18, pp. 220-233.

The following translation is in course of preparation by Mr. H. Brutcher, to whom enquiries should be addressed at P.O. Box 157, Altadena, Calif., USA:

HB 4787 ULTRASONICS—ONE OF THE METHODS FOR TESTING CASTINGS. Schinn, R. *Giesserei*, 1959, Dec. 17, pp. 977-980.

American Letter

Solidification of Die-cast Aluminium under Pressure*

This research was conducted primarily to explore the principles involved in the solidification of metal under extremely high pressures. The work was confined to simple cylindrical and rectangular cast blanks of A-356 aluminium alloy, having a cross-section area of 1 sq. in. In most cases the molten metal was vacuum degassed before casting. The percentage chemical composition of the alloy used was: Silicon 6.70-7.10; iron 0.20; zinc 0.11-0.14; magnesium 0.33-0.36, and titanium 0.13-0.15. The effect of pouring at pressures from atmospheric up to 44.64 tons per sq. in. was determined under the following variable conditions: (*a*) Air-melted and vacuum-degassed metal; (*b*) mould temperature from 177 to 427 deg. C.; (*c*) metal pouring temperature from 649 to 760 deg. C.; (*d*) time of pressure application after pouring, from 2.50 to 30 sec., and (*e*) surface to volume ratio, using round and rectangular moulds.

Results

Each test casting was examined for: Radiographic soundness; density; tensile strength (yield strength at 0.2 per cent. offset, elongation in 2 in., and Brinell hardness in the as-cast and T-6 heat-treated condition), and macro- and micro-structure.

Soundness: The radiographs indicated that a pressure greater than 8.93 tons per sq. in. was needed to produce satisfactory results. All the castings produced at 22.32 and 44.64 tons per sq. in pressure were sound, regardless of the pouring conditions used.

Density: The range of densities obtained were: Atmospheric pressure 2.675: 22.32 tons per sq in. 2.682, and 44.64 tons per sq. in. 2.683. This slight increase in density as a result of the application of high pressures was an indication that sub-microscopic liquid to solid shrinkage voids were being eliminated.

Mechanical Properties: The tensile strength and hardness of the aluminium alloy were improved with the application of ultra-high pressures. The improvement was greater before the bars were subjected to the T-6 heat-treatment. The yield strength was slightly improved by high pressures, and the ductility both as-cast and heat-treated was also materially increased. Elongations of 9 to 18 per cent. were obtained.

Macro- and Micro-structure: Under high pressure, the as-cast aluminium grains surrounded by eutectic were smaller than the dendritic grains of the atmospheric-pressure-cast alloy, which were also surrounded by eutectic. There was less eutectic present in the structure cast under high pressure. The increase in eutectic silicon concentration, refinement of eutectic silicon, increase in solubility of the silicon in aluminium, grain refinement, and filling of the solid to liquid shrinkage voids, could all or in part lead to increased hardness and strength in the alloy. The reduction of the amount of eutectic present undoubtedly caused the increase in elongation.

Vacuum Degassing

Tests on the as-cast properties of castings made at 4.46 and 8.93 tons per sq. in. produced a negative result, because of the cracks and fissures which had been formed. With pressures of 22.32 to 44.64 tons per sq. in., and after degassing, the yield strength was only slightly improved, but tensile strength rose to over 13.39 tons per sq. in., and elongation increased to more than 12 per cent. The improvement in properties brought about by the vacuum degassing is attributed to the removal of entrapped oxides and gases from the air-melted metal. The as-cast tensile strength increased with pressure, and decreased with increase of mould temperature above 260 deg. C. The yield strength and the elongation were increased by pressure at all mould temperatures. The T-6 heat-treated properties were less markedly affected. High pressures at all metal-pouring temperatures increased the tensile and yield strengths. The elongation was steadily increased up to 22.32 tons per sq. in. pressure.

Delay in Pressure Application

Pressure delay had little effect on tensile or yield strength, but the elongation at 5 sec. delay was exceptionally high. Also, this delay in pressure application of 5 sec. after pouring resulted in the centre portion of the bar being almost free of eutectic. With a 30-sec. delay the metal was entirely solidified, so there was little refinement of the micro-structure. The period of time during solidification that the pressure was applied was found to be critical. If it was applied too soon a concentration of eutectic was developed at the centre of the casting; if applied too late the structural changes did not occur at all.

The high pressures produced consistently high strengths and unusually high elongation under almost all casting conditions, and density, soundness and surface finish of the castings were excellent. Pressures of 22.32 tons per sq. in. yielded properties similar to that produced by 44.64 tons per sq in., but in addition were considerably less difficult to use.

* Summary of work done by J. L. Reiss and E. C. Kron, who are respectively: metallurgist and chief metallurgist, Doehler-Jarvis Division, National Lead Company.

Census on Foundry Processes

A recent census of the US foundry industry indicates that special processes have become more popular. The following analysis shows the classification and number of establishments using specific types of metal, and the casting methods employed.

Metal cast.	No. of firms.	Methods used.	No. of firms.
Grey iron	2,400	Sand	5,000
Malleable	125	Pressure-die-casting	1,200
Steel	500	Gravity-die-casting	900
Brass and bronze ..	2,500	Shell mould	500
Aluminium	3,375	Centrifugal	250
Magnesium	250	Plaster mould ..	250
Zinc	1,000	Investment mould ..	200

Forthcoming Exhibitions

During the next few months a number of exhibitions having stands of particular interest to founders will be held, as follow:

First International Compressed Air & Hydraulics Exhibition: Empire Hall, Olympia, London, April 25 to 29. The Second European Fluid Power Conference will run concurrently, from April 26 to 28.

Fourth Production Exhibition: National Hall, Olympia, London, April 25 to 30.

Mechanical Handling Exhibition: Earls Court, London, May 3 to 13.

Business Efficiency Exhibition: Bingley Hall, Birmingham, May 16 to 21.

Instruments, Electronics and Automation Exhibition: Olympia, London, May 23 to 28.

International Machine Tool Exhibition: Olympia, London, June 25 to July 8.

CAMMELL LAIRD & COMPANY, (SHIPBUILDERS & ENGINEERS), LIMITED—Mr. A. Duncan and Mr. P. A. J. Hernu have been appointed directors. Mr. Duncan joined the company in 1929 and became repair manager in 1956. Mr. Hernu joined the company in 1957 to take charge of its yard reconstruction programme.

Book Reviews

Tin and its Alloys. Edited by E. S. Hedges, M.SC., PH.D., D.SC., and published by Edward Arnold (Publishers), Limited, 41, Maddox Street, London, W.1; price £6 6s. net.

In addition to editing this book, Dr. Hedges has himself contributed one article, and has had as contributors four of his present or earlier colleagues. These are Professor J. W. Cuthbertson, D.SC., Professor E. C. Ellwood, B.SC., PH.D., Dr. W. E. Hoare and Mr. W. R. Lewis, B.SC.

In an introductory chapter, Dr. Hedges gives a fascinating historical introduction to the subject, which confirms that the oldest bronze casting emanates from Ur and dates from 3500 B.C. There follows a statistical section giving production and consumption figures geographically, but when covering industrial usage, only one figure is given—that for the making of tinplate which takes about 40 per cent. of the output. Chapter II, headed "Tin in Cast and Wrought Forms," is of great interest to foundrymen, as it deals with the early history of pewter and its decline due to the availability of better-decorated china and glazed earthenware for general use. The subject is brought right up to date by the detailing of the composition of modern pewter, and a good illustrated description is given of current practice in its manufacture. Included also are some useful notes for the use of designers of pewter articles. In this same chapter, under the heading "identifying old pewter," the difficulties of distinguishing genuine antique pewter from modern reproductions are detailed fully, and summing up, it would appear that there are no reliable means of verifying the authenticity of antique pewter articles offered for sale.

Fascinating stories are included in the book on the making of organ pipes and Viennese tombs in tin. Referring to the former, a description is given of the casting or "throwing" operation as conducted in the organ works of the combined firms of William Hill & Son and Norman & Beard at Hornsey, London. Briefly, the method used is worth quoting. In a room 30-ft. long by 20-ft. wide is the casting table made from a single slab of stone, rather more than 12-ft. long and 4-ft. wide. This slab is covered with a thick resilient layer of fustian cloth and over this is stretched a single piece of starched linen. The table is supported perfectly level at hip height on an iron frame. The metal, in the form of ingots mixed with scrap and waste cuttings, is melted in a gas-fired open melting pot, with continual stirring, the dross being skimmed off occasionally. When sufficiently heated, the metal is poured into a ladle, pivoted on supports at one end of the table, and the stirring is continued until cooling has produced the proper slurry-like consistency. The ladle is then tilted so that its contents discharge into a trough made of hard wood (mahogany or *lignum vitæ*) set across that end of the table. This trough is provided with guides and handles by which the caster and his assistant can pull it rapidly down the length of the table. As they do so, the metal escapes under the rear side of the trough leaving a thin semi-liquid sheet of metal in its wake. When cool enough to handle, the ragged ends are trimmed with a hook-shaped tool and the sheet is then rolled up and removed from the table.

Chapter III deals with the physical metallurgy of tin and its alloys and is embellished with tables and graphs, giving, *inter alia*, some physical properties of tin, mechanical properties of the metal and the structures of some intermetallic compounds containing tin. Included also in this chapter is a section on tin in other metals and technical descriptions are given of its effect on steel, grey-iron and nodular cast iron. The chemical behaviour of tin (Chapter IV) contains many technical data which are not readily accessible elsewhere and shows why tinplate is so popular in the canning industry. Sections are included on tin coatings on steel and copper. After a chapter on the electrodeposition of tin and its alloys, Chapter VI deals with hot-tinning, wherein are covered the tinning of cast iron, steel, copper and brass. Comparatively few firms carry out the hot-tinning of cast-iron as it can be a lengthy and complex process. The hints given in the six pages devoted to this are probably the most complete so far available. Among other points made are that cast irons which are required to be tinned are usually either ordinary grey irons or high-duty special cast irons such as are used increasingly for engineering applications. In general, it is stated that high-carbon, high-silicon irons are rather less amenable to tinning and it is deemed advisable not to exceed about 3.5 per cent. of carbon.

There will be comparatively minor interest for JOURNAL readers in Chapter VII on tinplate, but their interest will be re-established in the chapters which follow, covering tin in bearing alloys, die-casting and other tin alloys, solders, and the final chapter on bronzes. This final chapter contains sections on the metallography of binary and ternary bronzes, the melting and casting of bronzes, heat-treatment, and properties and uses of these metals.

The book is beautifully bound, it runs to over 400 well-illustrated pages and is admirably indexed.

V. C. FAULKNER

Mechanical World Year Book, 1960, and **Electrical Year Book, 1960.** Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3; price 5s. and 4s. net, respectively.

In this new edition of the "Mechanical World Year Book" the engineer is provided with many data in connection with the properties of cast material—both of ferrous and non-ferrous types; die-castings; weights of castings related to patterns made of various types of wood, and so on. A striking omission, however, is a table showing the contraction allowances to be made for the various types of metals cast in foundries. The fact that this Year Book has attained its 73rd birthday is good proof of its usefulness.

For the companion volume—"Mechanical World Electrical Year Book"—it is not so easy to find direct applications to foundrywork, but the same table for calculating casting weights is printed. Nevertheless, the volume is a compendium of information of vital interest for all works electricians. Not of minor interest for the reviewer was a section on "Safety precautions with portable electric tools." The electrical and magnetic properties of a number of materials are fully reported, including some cast alloys.

Both volumes are good value for practical men, and are kept well up to date.

TWO LARGE-TONNAGE OXYGEN PLANTS at Modderfontein in South Africa, erected for African Explosives & Chemical Industries, Limited, became operational in February. The plants, supplied by British Oxygen Linde, Limited, a sales company owned jointly by the British Oxygen Company, Limited, and Geselischaft fur Linde's Eismaschinen A.G., have a combined output of 310 short tons of oxygen and 320 short tons of nitrogen per 24-hour day, the gases being used to produce ammonia by the synthesis process.

Electrical Engineers' Exhibition

The ninth Electrical Engineers' Exhibition, at Earls Court, London, was opened at noon on April 5 by the President of the Board of Trade, the Rt. Hon. Reginald Maudling, M.P., who was introduced by Mr. G. G. F. Aldridge, chairman of the Association of Supervising Electrical Engineers. Sir Josiah Eccles, president of the ASEE, proposed a vote of thanks to Mr. Maudling.

In the course of a visit to the Exhibition, the JOURNAL'S representative noticed that many of the exhibitors were companies with foundries of their own. Discussions with representatives in attendance on the stands revealed that most of the exhibiting firms intend to continue to rely on castings for small parts, rather than change to plastics or fabrications. Some of the large components have been replaced by weldments, however. It was good to hear that, in the general opinion, to-day's castings bear little relation to those made in the pre-war period, in that they are much more accurately dimensioned, thinner sectioned, and considerably better designed.

In addition to those displays mentioned in the Exhibition preview a fortnight ago, the following stands were also of particular interest to foundrymen. B.I.P. Chemicals, Limited, were showing their polyester dough moulding compounds, which consist essentially of an unsaturated polyester resin combined with mineral fillers and glass or organic fibres as reinforcements. A variety of castings made from Noral alloy, including switchgear parts, motor casings, cooling fans and lighting fittings, were displayed by the Northern Aluminium Company, Limited. The Graphite Products, Limited, stand illustrated the range of Foliac graphite products, which includes die-dressings, annealing-oven chain lubricants, and colloidal graphite for the prevention of screw-thread seizure at high temperatures. Hellerman, Limited, were demonstrating their Dymo-Mite, which embosses white letters on a range of coloured plastics tapes, or plain letters on metal tapes. On the Armstrong Whitworth stand was displayed a piece of precision-machined beryllium, together with photographs and descriptions of its potentialities. Because of its value the metal was sealed in a polythene container, locked in a glass case, and insured for £1,000. A 7 by 17-ft. section of their new electrically-heated acoustic suspended ceiling was shown on the Simplex Electric Company, Limited, stand, together with a completely new range of Star switchgear. Electrical Products, Limited, displayed their Minibus miniature busbar system, which is designed to provide flexible power distribution for workshops, laboratories, test bays and tool-rooms. The Sofono electrical division of Federated Foundries, Limited, stand contained a full range of their electric heaters, convectors, convector/reflectors and reflector fires.

Data Sheet

The Association of Light Alloy Refiners and Smelters, Limited, 3, Albemarle Street, London, W.1, have published a revised edition of their mounted data sheet for aluminium casting alloys to replace the 1955 issue. The amendments concern mainly the "related specifications" section and are the result of the revision of the B.S. "L" series of aircraft standards and the transference of four D.T.D. specifications to the B.S. "L" series. One of these, the familiar D.T.D. 424A, will in future be known as B.S.L79. The B.S.1490 "LM" numbers remain unchanged. The data sheet is available free of charge to FOUNDRY TRADE JOURNAL readers on application to the address quoted above.

Revised Steel Prices

The Iron and Steel Board announces a revision of the maximum prices of a limited range of steel products with effect from April 11. The products concerned are stainless- and alloy-steels, cold-rolled carbon-steel strip and certain specifications of non-alloy bright steels bars and heavy rails. The changes, of which some are upward and some downward, represent corrections in the structure and, on balance, have no appreciable effect on the general level of steel prices.

The most significant changes are in stainless steel, the price schedule for which has been extensively recast in the light of experience gained in costs at modern plant. Broadly speaking, the maximum prices of stainless-steel bars are being increased and those of stainless-steel flat products decreased, but this does not apply to all sizes and qualities. The price increases for certain sizes of stainless-steel bars and the price reductions for the thinnest of the stainless-steel strip are substantial. Changes in the prices of the other products are much less marked.

GKN Ingot-moulds for USA

Guest Keen Iron & Steel Company, Limited, Cardiff (a subsidiary of Guest Keen & Nettlefolds, Limited), have recently exported a quantity of ingot moulds to the USA. The initial order was for 60 moulds each weighing over 32 tons, and these are among the largest moulds ever exported from South Wales. They were cast at the new ingot-mould foundry at Dowlais, which first came into production in November, 1958. The accompanying photograph shows one of the moulds being loaded at Cardiff Docks.

Personal

Mr. A. L. BUSBY has been appointed a director of Peter Brotherhood, Limited.

Mr. JOHN BOOTH, general manager of the Central Wagon Company, Limited, has been appointed an excutive director.

Mr. H. MCGLYN, B.SC., has been appointed quality control engineer at the Brighton factory of West Instrument, Limited.

Yale & Towne Manufacturing Company announce that Mr. GEORGE BEEBEE has been appointed comptroller of the British divisions.

Mr. F. J. HOUGHTON and Mr. K. D. A. BERTRAM have been elected directors of Pickford Holland & Company, Limited. Mr. S. B. TURNER has resigned.

Mr. LAWRENCE SUTTON, B.SC. (ECON.), who has been appointed education officer to the Institution of Works Managers, was formerly director of studies at Ashridge College.

Mr. FRANK WEBSTER of Augusts, Limited, Halifax, will be visiting the exhibition organized by the American Foundrymen's Society to take place in Philadelphia from May 9 to 13.

Mr. W. R. TODD, of Ferro Enamels, Limited, Wolverhampton, has been appointed director of commercial development (foreign) of the parent company, Ferro Corporation of Cleveland, USA.

Mr. T. J. MACARTHUR has resigned from the board of Stewart & Gray, Limited, vitreous enamellers of Mitcham, Surrey, and will relinquish his position with that company with effect from June 30.

Mr. A. C. BREARLEY, B.MET., F.I.M., technical director of Catton & Company, Limited, Leeds, was recently appointed to the additional position of director of Weir Foundries, Limited, Knowsthorpe, Leeds.

Mr. G. L. HODGSON, who retired on March 31, after 27 years as manager of the Birmingham office of the Stanton Ironworks Company, Limited, has been succeeded by Mr. G. A. ATTER, previously deputy manager.

Mr. S. E. CHALONER has been appointed controller of personnel of Monsanto Chemicals, Limited, and will be responsible for staff relations, recruitment and training, general personnel and industrial relations policies.

Mr. ARNOLD W. LEE, managing director of the Norton Grinding Wheel Company, Limited, has been appointed to the board of directors of Behr-Manning, Limited, Belfast, an associated company manufacturing coated abrasive products.

Mr. C. R. NEWTON, chief accountant of Cockburns, Limited, valve manufacturers, Glasgow, has been appointed a director of the subsidiary company, Cockburns (Springs), Limited. He retains his position as chief accountant with the parent company.

Dr. C. A. ZWEIGBERGK has been appointed director of the newly-formed British Electrical Approvals Board for Domestic Appliances. He takes up his duties on June 1. The organization was set up to operate an approvals scheme for domestic electrical appliances, and the Board comprises members of the British Electrical and Allied Manufacturers' Association and the British Standards Institution.

GRIFFIN & GEORGE, LIMITED, Alperton, Wembley, Middlesex, announce that Dr. A. J. P. MARTIN has expressed the desire to concentrate in future primarily on fundamental research work, and, therefore, wishes to retire as a director of the company. Dr. Martin will continue to be retained by the company in the capacity of consultant. He is succeeded, as director of research, by Mr. R. C. PALMER, M.A. (CANTAB.), his present deputy.

Mr. FREDERICK V. PIPE, O.B.E., managing director of Newton Brothers (Derby), Limited, electrical engineers, has retired. He has been associated with the firm for more than 40 years and was chairman of the company for eight years. He was also chairman of the Derby committee of the North Midlands Regional Board for Industry and is a former president of the Derby and Derbyshire Chamber of Commerce. He was awarded the O.B.E. in 1951 for services in industry.

Mr. WILLIAM KINSEY, M.B.E., technical director of Hattersley (Brassfounders), Limited, Ormskirk, retired on March 31 after 41 years' service with the company. He joined them in 1919 at Manchester (the firm was then United Brassfounders and Engineers, Limited) and was appointed technical manager in 1936, being made technical director when he was elected to the board in 1949. He was awarded the M.B.E. in 1946 for services to the Ministry of Supply in connection with the production of armaments.

On March 25, Mr. G. SAVILE STEVEN, the new chairman of Allied Ironfounders, Limited, took over from Mr. W. H. SMITH, who has retired after spending more than 60 years in the ironfounding industry. Mr. Steven is 53, and has been connected with the Allied group since 1925, when he joined McDowall Steven & Company, Limited, Falkirk. He was appointed deputy managing director in July, 1954, managing director in November, 1956, and vice-chairman and joint managing director in April, 1959.

Dr. J. C. HUDSON, head of the corrosion section of the British Iron and Steel Research Association, has been awarded the Sir Robert Hadfield bronze medal by the Iron and Steel Institute. This annual award, instituted in 1947, is a recognition of distinguished service in the development of the science of ferrous metallurgy. It is the second major award bestowed on Dr. Hudson within six months. In November last the American National Association of Corrosion Engineers gave him their Frank Newman Speller Award for 1959.

Mr. H. C. TOWN, head of the department of engineering at Keighley Technical College, will be retiring at the end of the summer term. Formerly chief lecturer in the department, he has been on the staff of the College for about 34 years. During his career he has twice won the Water Arbitration prize of the Institution of Mechanical Engineers; he is a gold medallist of the Institution of Production Engineers, and a past-president of the Keighley Association of Engineers. His text-book on machine tools is a standard work in most technical libraries.

Mr. PERCY HOPKINSON of British Furnaces, Limited, Chesterfield, a member of the B.H.D. (Engineers), Limited, group, has retired from the position of managing director but will continue to act in a consultative capacity. Mr. Hopkinson joined the Bryan Donkin Company, Limited (another member of the B.H.D. group), in 1906, and shortly after the formation of British Furnaces, Limited, in 1922, was placed in charge of that company. He was appointed director and general manager in 1941 and in 1950 succeeded the late Alderman George Clark as managing director. His successor is Mr. FRANK BONSALL who joined British Furnaces in 1927 and was appointed deputy managing director last year. Also appointed to the board are Mr. R. V. CUTTS, technical sales manager, and Mr. S. FARRER, managing director of Bryan Donkin. Mr. R. T. REDFERN, who was managing director of Bryan Donkin, and Mr. G. C. Chambers, technical director, retired on March 31.

News in Brief

INTERPLAS 61, the sixth International Plastics Exhibition and Convention, will be held at Olympia, London, from June 21 to July 1, 1961.

NINE SHEFFIELD STEELWORKS were toured by 20 full-time engineering students from Dundee Technical College during the week ended April 9.

THE INCANDESCENT GROUP announces that, from Wednesday, March 23, their London-office telephone number was changed from SLOANE 7803 to BELGRAVIA 7803-5.

AN ORDER from Russia worth £10,000 for the supply of small, vacuum insulated liquid-oxygen storage-tanks has recently been completed by British Oxygen Engineering, Limited.

T. F. & J. H. BRAINE, LIMITED, engineers, Leeds, have contributed £500, and West Yorkshire Foundries, Limited, Leeds, £200 to the Leeds section of the World Refugee Appeal Fund.

A NEW COMPANY—Sociedade Morro do Níquel—has been established in Brazil under the auspices of the Bank of Indo-China. It will work and process nickel deposits owned by Mineração Sertaneja S.A., in the State of Minas Gerais.

PURIMACHOS, LIMITED, manufacturers of refractory cements and waterproofers, have recently entered the boat-building field and have formed a subsidiary company, the Morwell Boat Company, Limited, to take over this side of the business. The address of the new company is 14 Waterloo Road, St. Philip's, Bristol, 2.

E.M.B. COMPANY, LIMITED, Moor Street, West Bromwich, have been allotted a stand at the forthcoming International Die-Casting Conference to be held at Stresa in Italy, from May 16 to 20. Mr. S. Smith will be in attendance to represent the company and to answer questions regarding their die-casting machines.

SIR HENRY SPURRIER, in his capacity as chairman of Albion Motors, Limited, on March 31 presented long-service certificates to Albion employees with 25 years' service. The 44 recipients, which included two ladies, had an aggregate service with the company of 1,100 years. In all, 734 long-service certificates have been presented to date.

THE 200-YD.-LONG WAREHOUSE of John Lee and Son, Limited, scrap-metal merchants, London Road, Grantham, was destroyed by fire on Saturday night, April 2. Firemen from eight brigades fought the fire for over ten hours. Until 18 months ago, the premises were the foundry and engineering workshops of Ruston and Hornsby, Limited.

AT SHORT NOTICE, Councillor A. Beaumont Dark deputized for Mr. Leonard Cleaver, M.P., who was to have spoken on "The Budget" at the meeting of the Non-Ferrous Club at the Queen's Hotel, Birmingham, on April 6. At this luncheon, a collection was taken on behalf of the World Refugee Year, the sum of £18 2s. 6d. being realized.

MEMBERS of the newly-formed Export Information Bureau of the British Society of Commerce recently visited the Tottenham works of Keith Blackman, Limited, manufacturers of fan-engineering equipment. During the visit they were shown a cross section of air moving and treating apparatus, including mine-ventilating equipment shortly to be shipped to Formosa.

WHEN J. C. BAMFORD (EXCAVATORS), LIMITED, Uttoxeter, Staffs, despatched an excavator to Moira, near Belfast, Northern Ireland, on March 31, there were a dozen large white loaves packed in the cab as part of the order. The order for bread had been added because of the strict rationing of bread in Northern Ireland due to the bakers' strike. The firm said they always meet their customers' requirements.

"PHYSICAL AND STRUCTURAL aspects of Non-destructive Testing of Metals" will be the theme of a joint conference of the Institute of Physics (non-destructive testing group) and the Société Francaise de Métallurgie, to be held in London, from May 2 to 4. The conference will be open to non-members and details are available from Mr. L. Lawrence, Institute of Physics, 47 Belgrave Square, London, S.W.1.

MAKING FORGED-STEEL ROLLS at Thos. Firth and John Brown, Limited, is the subject of a new industrial film which had its premier in Sheffield on April 5. It is made by the Firth-Brown Research Laboratories' photographic section and shows the use to which the rolls are put, including the production of sheet for cars, refrigerators and washing machines. About 50 per cent. of the rolls are exported.

MANY OF THE 167,000 ACCIDENTS in factories last year could have been prevented by wearing protective footwear and eye shades, said Mr. S. H. Carter, an inspector of factories, when he spoke to apprentices from Nottingham, Newark, Grantham and Mansfield at Nottingham on April 5. He said another major cause of accidents was lifting, and demonstrations were given of the correct ways of doing this.

FULLERS' EARTH UNION, LIMITED, announce that the trade name "Fulmont" will, in future, be applied to all their standard grades of activated fullers' earth The particular grade designations will follow this trade name and will remain the same as before in all cases. Assurance is given that the quality of these activated fullers' earths is in no way altered, the change being purely one of convenience in nomenclature.

TWENTY-SIX GIRLS and seven boys from the Stanton Ironworks Company, Limited, near Nottingham, have received awards under the Duke of Edinburgh's award scheme. Two of the girls and three of the boys qualified for Gold Awards and these will be presented to them by H.R.H. Prince Philip, at Buckingham Palace on May 18. The total number of Gold Awards gained by boys and girls from the company is now 14.

NEW OXYGEN-FED hot scarfing machines are to be installed at the Spencer works, near Newport, of Richard Thomas & Baldwins, Limited, and at the Ravenscraig works of Colvilles, Limited, near Motherwell. The equipment, valued at more than £350,000, will be supplied by British Oxygen Gases, Limited, and oxygen supplies to operate the machinery will come from BOG tonnage plants now being built for the steelworks.

A CONTRACT valued at $1,000,000 has been placed with Thomas Robinson & Son, Limited, Rochdale, the flour-milling engineers, by Liberty Flour Mills Incorporated of Manila. The contract calls for the erection and equipping of a complete flour mill with a capacity of 200 tons in 24 hours. Robinsons were awarded the contract for the first flour mill in the Philippines some two years ago, by Republic Flour Mills Incorporated.

PROSPECTING FOR GOLD, arsenic and antimony in the Que Que district, Southern Rhodesia, is to be carried out by a South African company. Under three exclusive prospecting orders granted by the Southern Rhodesia Government, the company—Johannesburg Consolidated Investment Company, Limited—must spend £39,000 on prospecting in the next two years. Two of the orders relate to 72 square miles in the Que Que area, and the other, 49 square miles in the Hartley area.

News in Brief

THE DOMINICAN REPUBLIC FIRM, Explotacion Minera Hatillo, has signed a contract worth $8,000,000 to supply West Germany with iron ore. The ore will be mined from deposits at Hatillo and shipped to the German firm, Ferrostaal Import-Export of Essen. The initial order is for 840,000 tons of ore spread over three years, and this quantity is expected to be gradually increased. The first shipment, of 25,000 tons, will leave the port of Haina at the end of this month.

ONE OF THE LARGEST diesel-engine conversion schemes to be undertaken within the sterling area is shortly to be introduced in the Middle East where 750 American petrol-engined trucks are to be fitted with Leyland diesel engines. Before completion the scheme is likely to cost around £800,000. A contract has already been placed with Leyland Motors, Limited, for 375 diesels of 125 h.p., and 375 of 150 h.p. They will be installed in American six-wheeled trucks of up to 20 tons carrying capacity.

A STRIKE at Sheepbridge Alloy Castings, Limited, Sutton-in-Ashfield, Notts, started on April 4 when 100 members of the Amalgamated Engineers Union refused at the weekend to make the wasted-time cuts, including the afternoon tea break, asked for by the firm when there was a change from a 44- to 42-hour working week. 300 more workers, including those of other unions, came out in sympathy on the following day The firm produces heat-resisting castings and aircraft components.

AT A CEREMONY on April 7, the Marquess of Exeter, chairman of Birmid Industries, Limited, officially inaugurated the £1,000,000 extensions to the plant at Birmetals, Limited, Woodgate, Birmingham, one of the group's associates. The development at Birmetals is in consequence of the current high demand for aluminium alloys, and the major item in the extensions is a large precision rolling mill, stated to be the only one of its kind in the UK and possibly in Europe, engaged on aluminium manufacture.

SIMMONDS AEROCESSORIES, LIMITED, a member of the Firth Cleveland Group, and its subsidiary, Firth Cleveland Instruments, Limited, will be exhibiting their full range of products at the International Samples Fair to be held in Milan from April 12 to 27. The exhibits will be staged in conjunction with Simmonds Italian subsidiary, Simmonds Italiana Construzioni Aeroaccessori S.p.A. Surform hand-tools, which are manufactured by Firth Cleveland Tools, Limited, and marketed overseas by Simmonds, will also be displayed.

CONTINUING THE $20,000,000 EXPANSION PROGRAMME inaugurated in 1956, United States Borax & Chemical Corporation, the American operating company of Borax (Holdings), Limited, are to instal a 1,300-ft. mechanized conveyor system at the open pit borate mine at Boron, California. Work on the project is due to start in May and will be completed in the autumn. The new conveyor system, which will replace the heavy-duty trucks currently used to haul ore from the bottom of the pit to the surface crusher, will reduce transport costs and also provide a flexible system for meeting increasing future demands.

THOS. FIRTH AND JOHN BROWN, LIMITED, Sheffield, were visited by members of the Council of British Manufacturers of Petroleum Equipment on April 6. They were led by Mr. H. S. Gedge, head of the Birmingham district sales office of the United Steel Companies, Limited, who is chairman of the Council's midland region, and were shown over the works by Major W. B. Todd, of the London office of Thos. Firth and John Brown, Limited. Mr. Gedge said at the lunch following the visit that a further £3,500,000 contract had been arranged with Mexico, in addition to the £7,000,000 refinery being built there. Credit for this is being facilitated by an organization formed by the Council for this purpose. Mr. T. H. Shaw, a director of Firth-Brown, Limited, presiding at the lunch, said the membership of the Council had increased from the original 93 members to nearly 500.

Mr. W. H. MCFADZEAN, national president of the Federation of British Industries, who was guest speaker at the annual luncheon of the Midland Region of the Federation of British Industries, in Birmingham, said that with the coming into operation of the "Outer Seven" trade pact on July 1, "We may well see the beginning of what threatens to become at least a temporary economic division of Europe." He reminded his audience that as a first step towards eliminating trade barriers entirely, the seven nations of the European Free Trade Association would cut tariffs amongst themselves by 20 per cent. The six nations of the Common Market would make a second 10 per cent. cut in the tariffs inside their own zone and the two trade *blocs* would therefore face each other precisely in line. He added that discussions at the economic conference, held in Paris last month, marked a critical round in the protracted struggle that had been going on between the "Six" and "Seven" for the past three years. Reviewing the work of the FBI, Mr. McFadzean said it now had 278 trade associations in its membership and almost 8,000 individual firms.

MR. J. MACNISH, chairman of the British Institute of Management, Midland Regional Council, welcomed delegates to the two-day conference of the BIM at Leamington on March 31-April 1. Lord Piercy, chairman of the Industrial and Commercial Finance Corporation, Limited, who gave the opening address, said of trade unions that their structure was now almost completely national and the legal status of the unions had evolved curiously, "with an uncalculated immunity from civil responsibility." The State, he said, had not been able to fit the unions into the common-law system of personal rights and individual contracts and "social invention has not caught up with this problem." The tremendous machinery of modern unionism clustered round the single idea of collective bargaining, Lord Piercy went on, and there had always been sanctions. The strike had for 75 years or more been conceded by the legislature to be a reasonable sanction and there had been a period when conditions in industry were such that this opinion could reasonably be held—"but as the general opinion of citizens with no union badge it is not held with complete conviction to-day." The theme of the conference was "The Role of Management in an Industrial Society."

Obituary

Mr. CYRIL JAMES SHENTON, chairman of James W. Shenton, Limited, ironfounders and general engineers, Tipton, Staffs, has died at the age of 59.

The death has occurred of Mr. EDGAR WRIGHT who, before he retired last year, had completed 60 years' service with the Renishaw Iron Company, Limited, near Sheffield.

Councillor ARTHUR S. GILLIES, who died on April 3 at the age of 58, was Scottish representative for Fairbairn Lawson Combe Barbour, Limited, Leeds. After the last war he became principal of the research and development department of the firm in Dundee. He was a member of Dundee Town Council for a year.

LSR 81 Grinder at work on a heavy casting

COMPRESSED AIR for the FOUNDRY

Atlas Copco puts compressed air to work for industries of every class—light, medium and heavy. For foundry work there are Atlas Copco rammers, chipping hammers and grinders carefully balanced to reduce operator fatigue and ensure the best possible results. For example, rammers are designed to "walk" with a minimum of guidance, allowing the operators to give all their attention to tamping.

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Atlas Copco heavy duty grinders are easier, less tiring to use. They combine maximum power with minimum size and weight and are designed for the quietest possible operation. Special safety governors ensure constant speeds regardless of varying loads. These grinders open the way to increased output; with Atlas Copco R-type chipping hammers they form a range of robust, reliable tools for all types of fettling and dressing operations.

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With companies or agents in ninety countries, Atlas Copco is the largest organisation in the world specialising solely in compressed air equipment. Products include stationary compressors from (2.5 to 20,000 c.f.m.) ·08 to 566m³/m portable compressors, air tools, rock drills, loaders and paint-spraying equipment. Wherever you are, the international Atlas Copco group offers expert advice and provides a complete after-sales service.

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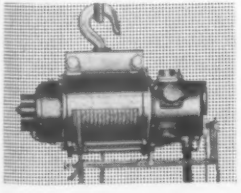
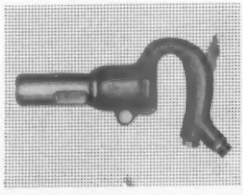


R3B Chipping Hammer



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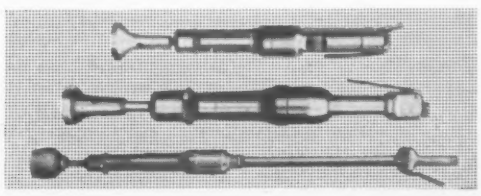

Imports and Exports of Iron and Steel in February

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in February this year. Totals for the first two months of this year and last are also included.

Total Exports of Iron and Steel

Destination.	Month ended Feb. 29.	Two months ended February 29.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Cyprus	114	187	254
Sierra Leone	364	915	783
Ghana	1,017	4,901	3,125
Nigeria	4,697	10,465	10,883
Union of South Africa	5,090	11,121	12,103
Rhodesia and Nyasaland	1,740	3,595	3,246
Tanganyika	850	4,854	1,502
Kenya	1,551	5,593	3,587
Uganda	154	1,041	315
Mauritius	159	286	464
Aden	121	315	247
Bahrein, Qatar, and Trucial States	1,384	2,651	1,546
Kuwait	552	2,936	672
India	24,876	24,072	40,008
Pakistan	6,487	6,562	14,212
Singapore	521	4,651	2,491
Malaya	1,775	1,812	3,206
Ceylon	4,626	7,649	9,621
British North Borneo	613	342	935
Hongkong	5,523	9,894	11,886
Australia	16,792	18,053	30,535
New Zealand	7,895	15,036	15,433
Canada	15,969	17,963	39,117
Jamaica	2,186	3,363	4,076
Trinidad	2,467	5,863	6,843
British Guiana	689	982	1,222
Other Commonwealth countries	3,285	8,839	6,217
Eire	5,976	6,724	10,259
Soviet Union	1,246	518	3,460
Finland	3,402	3,732	6,449
Sweden	16,264	20,821	40,332
Norway	10,659	14,159	23,425
Denmark	8,615	11,739	17,982
Western Germany	15,474	17,431	35,017
Netherlands	13,310	9,882	24,403
Belgium	3,253	4,691	7,911
France	838	430	1,207
Switzerland	1,056	1,473	2,345
Portugal	1,483	2,971	2,622
Spain	1,687	2,669	2,829
Italy	3,178	7,582	7,783
Austria	150	421	612
Yugoslavia	1,738	796	1,906
Greece	1,404	1,391	3,127
Turkey	174	1,117	357
Netherlands Antilles	458	486	1,294
Portuguese East Africa	327	295	883
Egypt	2,313	536	3,679
Sudan	1,722	2,041	2,176
Lebanon	155	65	274
Israel	1,927	1,362	5,214
Saudi Arabia	73	631	98
Iraq	2,306	20,906	5,538
Iran	7,832	6,220	15,308
Burma	1,841	1,299	1,931
Thailand	224	1,785	1,934
Indonesia	1,982	609	4,663
China	6,353	17,678	13,804
Japan	2,529	3,425	11,137
Philippine Republic	485	520	2,132
USA	31,821	14,589	62,493
Cuba	588	1,080	1,558
Colombia	1,610	188	2,400
Venezuela	4,242	14,421	8,244
Ecuador	369	261	494
Peru	638	481	1,087
Chile	271	160	446
Brazil	985	1,923	3,424
Uruguay	1,071	277	1,911
Argentina	8,606	40,073	18,782
Other foreign countries	7,891	6,550	22,911
TOTAL	290,023	420,349	610,370

Total Imports of Iron and Steel

From	Month ended Feb. 29.	Two months ended February 29.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Union of South Africa	5,991	3,180	9,584
Rhodesia and Nyasaland	505	581	1,500
Canada	2,366	986	5,804
Other Commonwealth countries and Eire	2,209	1,465	6,515
Soviet Union	3,179	705	7,607
Sweden	4,418	4,539	7,228
Norway	13,335	11,468	22,120
Poland	3,000	466	3,086
Western Germany	11,907	3,924	26,443
Netherlands	14,106	10,919	30,114
Belgium	6,616	2,839	11,189
Luxembourg	1,016	894	1,661
France	5,286	2,254	9,327
Italy	1,285	130	2,345
Austria	1,455	392	2,038
Japan	751	300	1,175
USA	9,513	954	11,806
Other foreign countries	3,225	1,398	4,094
TOTAL	90,163	56,394	163,636
Iron and steel scrap and waste, fit only for the recovery of metal	17,707	707	23,606

Exports of Iron and Steel, by Product

Product.	Month ended Feb. 29.	Two months ended February 29.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Pig-iron	18,669	20,950	44,416
Ferro-columbium (niobium)	7	12	21
Ferro-tungsten	101	334	208
Other ferro-alloys	861	573	1,537
Ingots, blooms, billets, slabs, sheet bars (incl. tinplate bars), and similar primary forms	7,740	18,707	13,302
Pieces roughly shaped by forging	68	74	113
Iron bars, rods, angles, shapes, and sections	138	128	346
Steel bars, rods, angles, sections, and shapes	50,839	42,045	111,475
Iron plates and sheets	111	12	147
Universal plates			
Steel plate, 3mm. and under 4.5mm. thickness	3,377	5,051	5,813
Ditto, 4.5mm. or more in thickness	26,069	17,645	50,460
Blacksheets and blackplate	24,091	40,727	53,547
Hoop and strip	8,691	11,513	16,335
Tinplate	49,549	79,238	107,197
Decorated tinplate	269	2,352	513
Galvanized sheets	5,886	13,731	11,131
Other (incl. tinned sheets, terneplate, and ternesheets)	1,661	2,118	5,856
Railway and tramway construction material	10,828	31,677	19,482
Wire rods of steel (incl. alloy steel)	4,648	5,290	11,632
Wire	9,977	15,417	19,675
Tubes, pipes, and fittings	64,775	111,050	133,638
TOTAL	290,023	420,349	610,370

THE SECOND INTERKAMA (International Congress and Exhibition for Instrumentation and Automation) is to be held in Düsseldorf from October 19 to 26.

THE PRESIDENT of the Sociedad Minera y Metalùrgica del Yaracu, Venezuela, stated recently that operations would shortly start at the lead, zinc, silver and gold deposits discovered two years ago in the district of Buzual, Yaracuy.

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EXTREME RESISTANCE TO ABRASION
(Hardness of aggregate 7·5 MOHS. Cuts glass)

ENORMOUSLY HIGH STRENGTH IN A MATTER OF HOURS
(For example 12,000 lb. per sq. inch at 24 hours and 16,000 lb. per sq. inch at 7 days)

HIGH DENSITY
(167 lb. per cu. ft. air-dried—20 lb. per cu. ft. higher than normal)

HEAT RESISTANT
(up to 1,150/1,200°C.)

OR ALL ABOVE PROPERTIES COMBINED

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APG1

Raw Material Markets

Iron and Steel

For their present record outputs the steelworks are utilizing large tonnages of basic pig-iron and heavy demands for supplies are being made on producing furnaces. Stocks have been reduced and demands for scrap from the steelworks are substantial. In many instances supplies fall short of requirements, and larger amounts of pig-iron have to be used in melts.

Overall the ironfoundries are also absorbing appreciable quantities of all grades of pig-iron, although, comparatively the demand is heaviest for the low phosphorus irons required by the engineering and speciality foundries for the production of high quality castings. The difficulty which has existed in obtaining sufficient supplies of this grade of pig-iron has now been removed by the larger number of furnaces producing this iron. One or two brands are still limited in supply, but the foundries have no difficulty in covering their needs from other producers in equal analyses.

Appreciable quantities of hematite are also being taken up by the engineering foundries, and these demands, together with the increased requirements of the steelworks for ingot moulds, etc., has stepped up production of hematite considerably, so that most producers are working up to capacity levels. Refined iron makers are also supplying fairly good tonnages to these foundries. The call for high phosphorus irons is maintained at the recent improved levels, but foundries have no difficulty in securing the tonnages they require.

Production of castings at the ironfoundries shows little change. Those making high-duty castings continue well employed, apart from the foundries catering chiefly for collieries and railways. Outputs are affected adversely by the shortage of suitable labour, but the work on hand is sufficient to ensure production at maximum levels and demands show no signs of diminishing. Makers of castings for the machine-tool trade maintain their improvement and the foundries supplying high-duty castings to other industries are also well employed.

The building trade shows no sign of slackening off in demand for castings and fairly good quantities are also being supplied to the domestic utensil trade. Many of the jobbing and textile foundries could do with more work. Most of the scrap required, is obtainable apart from the better and heavier grades of cast-iron and machinery scrap.

The re-rollers have good order-books, and the work now on hand will keep most of them fully occupied for some months ahead. There is no slackening in the call for small bars and light sections, and heavy demands continue to be made for reinforcing rods.

Production at some units is seriously impeded by shortage of labour, and the scarcity of billets particularly in 2-in. size is also having its effect. Home steelworks are sending forward substantial quantities of steel semis, but owing to shortage of stocks at the re-rollers these go into immediate consumption so that rollings depend on the amount of steel semis available.

All arisings at the steelworks of suitable re-rolling defectives and crops are readily accepted.

Non-ferrous Metals

Copper in London is firm: demand is concentrated on prompt metal and with stocks now down to almost dangerously low levels, prices have gone ahead and the backwardation has widened. Good demand characterizes the market; good from the UK and from the Continent, although a proportion of the latter is for May delivery.

The undertone, too, has hardened, due in part to the continued uneasiness felt about the South African situation and to the incipient fear that it may lead to similar troubles in Rhodesia and the Belgian Congo. It is also due to the better sentiment which, on balance, is prevailing in the copper market on the other side of the Atlantic. The US market has, however, had these "flashes in the pan" before, but should the better advices now being received harden into a discernible trend, prices in London and in New York would benefit. At present the price of 33 cents a pound (equivalent to £264 a ton) is applicable to both custom smelters and producers.

The immediate outlook is good. Beyond that, the political situation in South Africa could easily dominate markets and dictate prices. Technically, the only strong bullish influence is the low level of stocks which will not withstand much in the way of sustained demand. On the other hand, the possibilities are that American copper will cross the Atlantic to raise stocks and lower prices. This last clearly depends entirely on whether demand in the US gets on to a higher level—and stays there.

Tin is still quietly steady in London. The market has taken the new and enlarged quota period well and after a nervous start last week has recovered with the price relatively stable around £790 a ton. The US market is quiet, but the price is trying to go higher. At present it is fractionally below $1 a pound.

Lead in London reached a price of £78 3s. 9d. last week, the highest level since November 29, 1957. Since then it has slipped back slightly, but the market is still basically firm. The position is that supplies coming on to the market are strictly controlled and prompt metal is none too plentiful at any time. Thus a squeeze can quite easily develop. However, stocks in the hands of producers are high so that there is no real reason why prices should get out of hand. In this context it is worth remembering that the Board of Trade holds stocks of the metal amounting to 14,000 tons. In the US the market is fair and the price is unchanged at 12 cents a pound (equivalent to £96 a ton).

Zinc is firm in London. Demand was a shade patchy last week but this condition has now disappeared and the market is going ahead again. Turnover is satisfactory and the backwardation is widening, although there is little chance of a scare shortage developing. In the US demand is reasonably good but no long-term trend has emerged yet. The price is unchanged at 13 cents a pound—equivalent to £104 a ton.

BICC's New Company

British Insulated Callender's Cables, Limited, announce the formation of a new company, Telcon Metals, Limited. As from April 1, this company, centred at Crawley, assumed responsibility for all the activities of the metals division of the Telegraph Construction and Maintenance Company, Limited.

The board of directors of the new company is as follow: Mr. W. C. Handley, chairman; Mr. W. F. Randall, deputy chairman and managing director; Dr. G. A. V. Sowter, commercial director; Dr. H. H. Scholefield, technical director; and Mr. D. Norman-Thomas. Mr. L. D. Todd is the secretary. In addition to operating the factory at Crawley, Telcon Metals, Limited, will control the following subsidiary companies: Magnetic & Electrical Alloys, Limited, Burnbank, Hamilton, Lanarkshire; Telcon-Magnetic Cores, Limited, Chapelhall, Lanarkshire; Temco, Limited, Lydbrook, Glos, and Toolpro, Limited, Essex.

Baker Perkins Foundry Machinery at work . . . *at Joseph Bloomer & Sons Ltd.*

This 'Cadet' Rotary Table Shot Blast machine has been installed at Joseph Bloomer & Sons Ltd. where its high standard of finish and sound design have made it an extremely useful addition to this company's foundry equipment. This machine includes our patented bi-phase impeller system with low power consumption. No pits or special foundations were necessary. Please write for full details.

Baker Perkins Ltd.

Foundry Machinery Division

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PHONE : JARROW 897124

BP/F1

HISTORICAL NOTE

Joseph Bloomer & Sons Ltd. were established in 1860. At their Ladysmith Foundry and Chain Works, which are in Cradley, Staffordshire, they produce a wide range of castings for gas and calor gas cookers, agricultural and textile machinery, the motor industry, continuous burning fires and stoves and many other applications.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

April 13, 1960

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 7s. 6d.; Birmingham, £25 14s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £41 10s. 0d. to £44 0s. 0d., scale 15s. 0d. per unit, lumpy; 75 per cent. Si, £57 0s. 0d. to £62 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-Vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 11s. 8d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 14s. 8d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £78 10s. 0d. to £82 10s. 0d., basis 60 per cent. Cr. scale 26s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £77 0s. 0d. to £80 10s. 0d., basis 60 per cent. Cr, scale, 26s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent, C,* 1s. 8¼d. to 1s. 11¼d. per lb. Cr; 0.15 per cent. C,* 1s. 9¼d. to 2s. 0¼d. per lb. Cr; 0.10 per cent C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10¼d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £63 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

* Average 68-70 per cent.

FINISHED STEEL

Heavy Plates and Sections (1 ton to 10 tons).—Ship plates (N.-E. Coast), £41 12s. 0d.; boiler plates (N.-E. Coast), £44 2s. 0d.; floor plates (N.-E. Coast), £43 10s. 0d.; angles (N.-E. Coast), £38 16s. 6d.; joists (N.-E. Coast), £38 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £67 17s. 0d.; nickel-chrome, £98 11s. 0d.; nickel-chrome-molybdenum £111 4s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £261 10s. 0d. to £262 0s. 0d.; three months, £241 10s. 0d. to £242 0s. 0d.; settlement, £262 0s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 5½d. per lb.; rods, 275s. 0d. per cwt. basis; 20 s.w.g., 310s. 0d. per cwt.

Tin.—Cash, £786 10s. 0d. to £787 0s. 0d.; three months, £784 10s. 0d. to £785 0s. 0d.; settlement, £787 0s. 0d.

Lead (Refined Pig).—First half April, £76 15s. 0d. to £77 0s. 0d.; first half July, £76 0s. 0d. to £76 2s. 6d.

Zinc.—First half April, £92 0s. 0d. to £92 5s. 0d.; first half July, £89 0s. 0d. to £89 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £125 15s. 0d.; rolled zinc (boiler plates), all English destinations, £123 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £105 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 0½d. per lb.; sheets to 10 w.g., 224s. 0d. per cwt.; wire, 2s. 10½d.; rolled metal, 224s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £166; B6, £220.

Brass (High Tensile).—BS1400, HTB1, £197; HTB2, £216; HTB3, £229.

Gunmetal.—BS1400, LG2, £208; LG3, £218; G1, 1%, £276; G1, 1%, £263.

Phosphor Bronze.—BS1400, PB1 (AID released), £305; BS1400, 90/10/1, £292.

Leaded Phosphor Bronze.—BS1400, LPB1, £229.

Phosphor Bronze Strip, etc.—Strip, 315s. 9d. per cwt.; wire, 4s. 3½d. per lb.; rods, 3s. 6½d.; tubes, 3s. 6½d.; chill cast bars, solids 3s. 6½d.; cored 3s. 7½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £70 10s. 0d. to £71 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £255; AB2, £263.

AEI Group Activities

The first annual review since the completion of the reorganization of the trading activities of Associated Electrical Industries, Limited, shows an increase in sales of 14½ per cent. and an increase in trading profits of 6½ per cent. Over the past 10 years AEI sales have risen from £57,000,000 to £208,000,000, while the trading profits have slightly more than doubled.

Orders received during the year increased to £182,000,000 (£168,000,000) and year-end orders in hand were valued at £173,000,000 (£182,000,000).

Much interesting information was collected on research on the wear of metals both in normal friction and in metal cutting. It has proved possible to redesign the shape of tools to give longer life and to make an evaluation of new metals for cutting tools.

"Give Me Your Answer, Do" Challenge to Chairmen

A challenge to a penny-farthing bicycle race has been thrown out to any company chairman whose firm celebrates its 200th anniversary this year. The challenge is issued by Mr. S. Martin de Bartolomé, chairman and managing director of Spear & Jackson, Limited, sawmakers, etc., of Sheffield.

If there are any acceptances, the race would be part of the company's own 200th anniversary celebrations in June. Mr. de Bartolomé has himself never ridden a penny-farthing.

The task of finding machines for the race has been given to Mr. Remington Wilson, a director of the firm.

Output of UK Farm Machinery is increased

As production of farm machinery increases rapidly, all the major manufacturers have announced plans to raise capacity. Last year there was a 20 per cent. rise in tractor exports and this year output is expected to be about 15-20 per cent. higher than in 1959. Manufacturers expect that the annual level of home sales, which has been running at about £50,000,000, will at least be maintained this year, although the market will be increasingly competitive. Exports, which account for more than half the industry's output, may exceed last year's record of £105,000,000.

There is, however, anxiety about the level of imports, which now account for 10-12 per cent. of the home market. Some continental manufacturers, particularly the Germans, are planning further encroachments this year.

Industrial Production levels off

The index of British industrial production has levelled off, after its 12-point increase since the beginning of last year. On a seasonally adjusted basis the index is now estimated to have been 119 (1954=100) in January compared with 117 in December and 107 in January, 1959. The provisional figure for February is 118-119, although it is subject to revision.

There are indications that the demand for goods in Britain continues to rise. In the Midlands and Southern England, where manpower reserves are small, labour shortages are affecting some smaller firms.

PIG IRON, **All Grades**
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CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Numbers 2/6 extra (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

30-YEAR-OLD ex-foundry manager now engaged on sales seeks opportunity with progressive company. Capital available. Box TY553, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY MANAGER, 31, H.N.C., C. & G., M.I.B.F., desires change. Position as Manager or Technical Executive envisaged. Salary £1,250 per annum. Yorks area preferred. Box AF567, FOUNDRY TRADE JOURNAL.

YOUNG FOUNDRY EXECUTIVE cast iron (31) with National Foundry College Diploma and Higher National Certificate in Metallurgy seeks position where initiative and fully comprehensive foundry experience are required. Present position complete control Sand Foundry (jobbing and mechanised). A.M.I.B.F. Salary £1,500/£1,750. Box YF503, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

FOUNDRY FOREMAN required for Jobbing Foundry situated home counties and engaged in the production of high duty Iron Castings. Must be experienced in control of labour. Age 40-45. Contributory pension scheme. Send details of experience and salary required to Box FF565, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY FOREMAN required for expanding Ingot Mould and heavy engineering castings foundry in South Wales. Applicant should be a practical man with a foundry apprenticeship and preferably hold a similar position. Age 35 to 45. Applications should be made in writing to Box AF538, FOUNDRY TRADE JOURNAL.

BRIGHTSIDE

APPLICATIONS are invited for the position of **SALES REPRESENTATIVE** for the "FOUNDRY DIVISION" of this Company, to operate from the Head Office at Ecclesfield.

APPLICANTS should have qualifications or experience in either of the fields covering the following products:—

(a) Ingot Moulds and Melting Shop Castings.

(b) General Engineering Iron Castings.

Replies, which will be treated in the strictest confidence, should be addressed to the SALES DIRECTOR, marked PERSONAL, and forwarded to:—

THE BRIGHTSIDE FOUNDRY & ENGINEERING CO. LTD.,
G.P.O. BOX 118,
SHEFFIELD, 1.

SITUATIONS VACANT—*contd.*

GLASGOW FOUNDRY and Engineers Supplier require TRAVELLER already calling on firms, Scotland. Commission basis. Good lines and stocks. Box GF520, FOUNDRY TRADE JOURNAL.

FOUNDRY METALLURGIST required for Foundry on the North East Coast of Scotland producing Blackheart Malleable Castings. Excellent opportunity for young Metallurgist in possession of Ordinary National Certificate in Metallurgy with experience in sand control, heat treatment and chemical analysis. Pension Scheme and free Life Assurance. Successful applicant must be prepared for shift work. Reply stating age, experience and salary required to Box FM554, FOUNDRY TRADE JOURNAL.

MERSEYSIDE Iron and Non-ferrous Foundry with capacity of 120 tons per month invites applications for the position of MANAGER. Applicants must be capable of controlling Sales, Production, Quality, Labour and General Administration. A sound knowledge of Metallurgy and Sand Control techniques is essential, together with extensive experience of semi-mechanised production, loose pattern and shell moulding. Non-contributory Pension Scheme and mileage allowance or car provided. Apply to Box MI545, FOUNDRY TRADE JOURNAL.

ASSISTANT WORKS MANAGER required for expanding Company in South Wales, engaged in the manufacture of Ingot Moulds, heavy castings and in general engineering. He would be responsible to the Works Manager for assistance in the supervision and control of machine and fabricating departments, works maintenance and development. This is a Staff position with a contributory Pension Scheme and with good future opportunity for advancement. Applicants should have had a general engineering apprenticeship and be qualified to National Standard as a minimum. An all round practical experience of engineering practice is necessary. The preferred age would be 30/40 years, and the starting salary would be by negotiation, based on experience, qualifications and ability. Applications should be made in writing to Box AW537, FOUNDRY TRADE JOURNAL.

SENIOR DRAUGHTSMAN

required

For design of plant and layout for manufacture of investment-moulded steel castings. Should hold H.N.C. and have had experience in connection, preferably with this type of process, or in steel foundry or other metallurgical plant, or chemical plant. Applications, giving appropriate details of experience, should be sent to the

Personnel Officer,
Fairey Aviation Limited,
Hayes, Middlesex.

SITUATIONS VACANT—*contd.*

FOUNDRY FOREMAN required by West Midlands ironfoundry. Must have experience in mechanised production of small iron castings and must be accustomed to control of labour. In replying please give full details of experience, qualifications and salary required. Box FF555, FOUNDRY TRADE JOURNAL.

WANTED. Floor and Bench MOULDERS, experienced in non-ferrous and light alloy specifications for jobbing foundry. Apply: STARLING FOUNDRIES LTD., 46, Pitlake, Croydon.

PATTERNMAKERS—Wood and Metal—required. Coventry Area. High rates—Bonus. Ideal conditions. Box PW514, FOUNDRY TRADE JOURNAL.

GRAVITY DIE-CAST BRASSWARE

A LARGE South African foundry is commencing the production of gravity die-cast brass fittings and requires the services of a competent and experienced FOUNDRYMAN to take control of the new department. Apply, giving fullest details, to:

CITY ENGINEERING & CARRON LTD.
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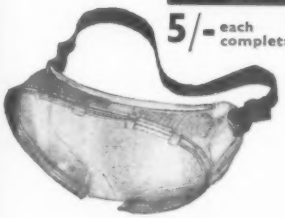

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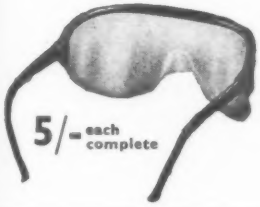

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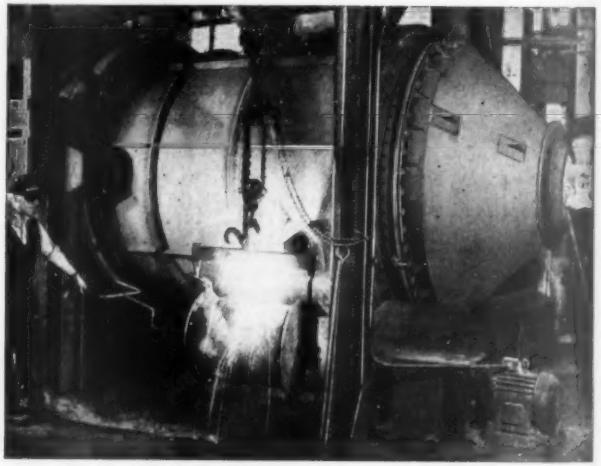

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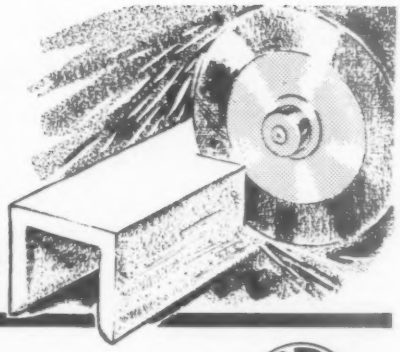

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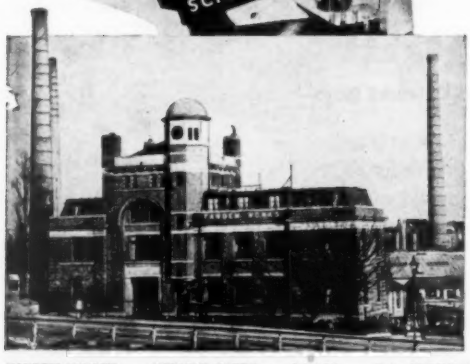

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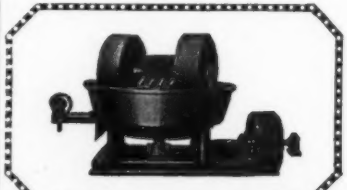

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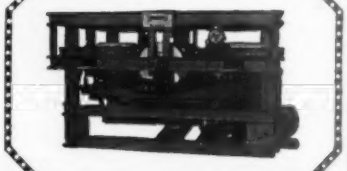

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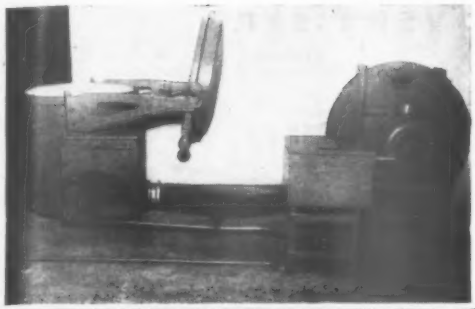

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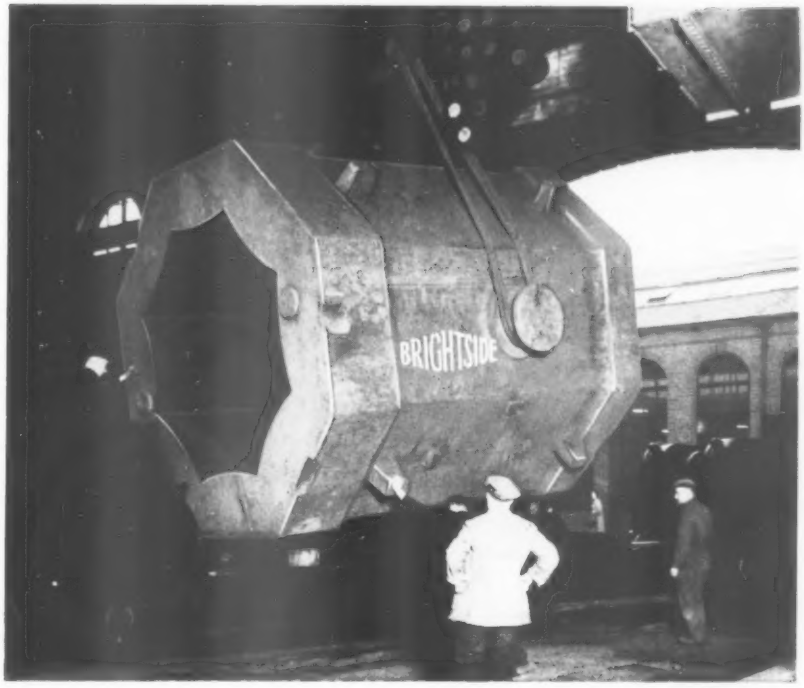

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VOL. 108
No. 2262
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